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VIEWS, NEWS AND INTERVIEWS.

"I have reached that point," said an electrical engineer, "where I can believe almost anything of electricity. Inventors are doing things to-day that a few years ago were hooted at and considered impossibilities. It takes nearly all my time to keep track of new things."

Among the notable recent visitors at New Orleans was Samuel Edison, father of the famous inventor. Mr. Edison came directly from his home in Michigan, and was on his way to Florida, where he expects to spend the Spring months at the extensive orange groves which belong to his son. The rigid climate of more northern regions affected in some degree the old gentleman's health, which he hopes to find benefited by the balmy breezes of the sunny South. In personal appearance Mr. Edison strikingly resembles James G. Blaine. In fact, the only perceptible difference, as the old gentleman observed, lies in political opinions. Mr. Edison is extremely tall, and bears himself erect despite his 88 years. His face is fine and impressive, seamed with fine wrinkles and surrounded by a wealth of white whiskers. He has keen, blue eyes that twinkle merrily beneath bushy eyebrows. The old gentleman talked freely of his famous son, whom he had recently visited at his home in New Jersey. "New Orleans ought to take unusual interest in my son," said Mr. Edison, falling into a reminiscent mood. "It was in 1867, if I remember rightly, that he was employed in this city as a telegrapher. He always was a bright, enterprising young fellow, and he made quite a success here; but one of the traits he inherited from me was a propensity to wander, and so in the following year he got a situation on a vessel bound to Rio Janeiro and the coast of the Argentine Republic. My son could not stand the seasickness which attacked him soon after getting into open water. He grew so thin and weak that when his ship touched at Vera Cruz the doctor sent him ashore to recuperate. He spent quite a while in Aztec land and came north after a short visit to Cuba." Mr. Edison expects to go to Amsterdam, the city of his father's birth, and spend the next year or so in a tour through Holland.

An effort is being made to build up a big india rubber industry in Mexico, and a company has been organized to plant 100,000 rubber trees in the state of Sinaloa.

There is a scheme on foot to place an electric search-light on top of Mount Washington of such high candle-power that it may be visible for a radius of 25 miles about the country. It is intended simply as an advertisement, and would doubtless add to the attractiveness of this popular resort.

According to the reports for 1891 of the Fire Insurance Patrol of Philadelphia, out of the 1,296 fires that occurred during the year not one was due to electricity; kerosene oil leads the list of causes, and the carelessness with matches comes in a close second.

It will cost $1,000,000 to equip the Lowell and Suburban Railroad with electricity for motive power.

Electricity vs. Steam.

A COMMISSION OF RAILROAD EXPERTS CONSIDERING THE SUBJECT.

A dispatch from Pittsburgh, dated January 27, says that a commission of nine railroad experts has been investigating the subject of electrical transportation as applied to railroads. The commission represented the Northern Pacific, Wisconsin Central and other roads. The members visited the Edison works, the Thomson-Houston works at Lynn, Mass., and then spent two days at the Westinghouse works. The result of their labors, which have been concluded, and the intentions of the railroads they represent were partially revealed by Chief-Engineer McHenry of the Northern Pacific Company, whose headquarters are at Tacoma. He said: "I believe that the motive power will be applied directly to the axles of each car, thus making each car its own motor. Experiments are to be proceeded with at once; they will take place at the various works and much of the cost will be borne by the railroads. I don't see why electricity should not displace locomotives, especially over steep grades. The question which will be most difficult of disposal will be the transmission of the current and the obtaining of adequate conductivity in the wires."

Buffalo Electrical Society.

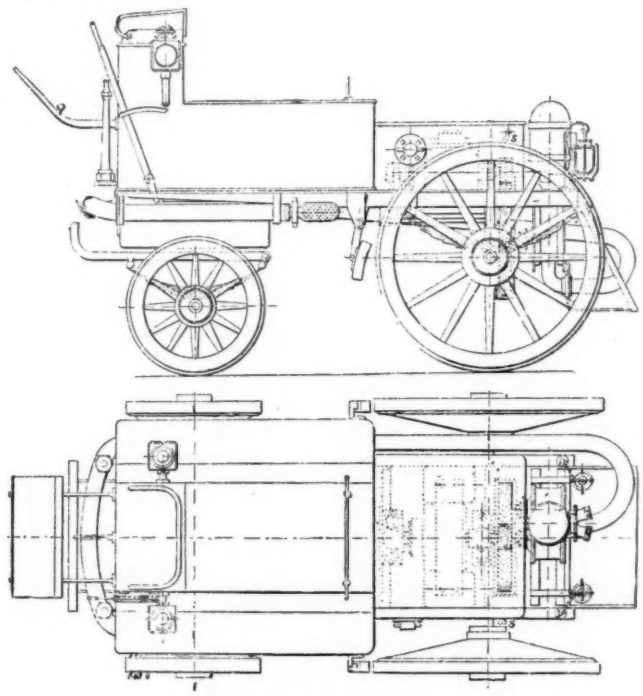
The society has issued a neat catalogue of the electrical books in its library together with its library regulations.

A Receiver for the L. J. Wing Company.

Levi J. Wing, president of the L. J. Wing Company, manufacturers of ventilators, at 126 Liberty street, has been appointed receiver of the company on application of the directors. Liabilities, about $21,000; assets, $18,000.

An Electric Fire Engine.

Messrs. Siemens Brothers & Company's electric fire engine, as exhibited in operation at the Royal Naval Exhibition, is illustrated in elevation and plan herewith. The carriage and frame were constructed by Messrs. Merryweather & Sons, and are exactly in accordance with those supplied by this firm for use by the Metropolitan Fire Brigade. The frame is of mild steel, carefully stayed and supported on steel springs, high wood spoke wheels, mail axles, and wrought iron locking-fore carriage, capable of locking completely under the body to facilitate turning in confined situations. The hose-box is of mahogany forming a seat for the firemen and fitted with the usual handrails and driver's seat. A foot plate is also fixed behind to carry two men.



AN ELECTRIC FIRE ENGINE.

The pump is driven through helical gear by means of a Siemens' motor type H H $\frac{15}{6}$, which is capable of developing 20 electric horse-power at 1,000 revolutions per minute. The armature is of the Gramme ring type and drives directly a helical pinion, which overhangs the main bearing and is in gear with the rotary pump. The bearing brackets and electro-magnets are bolted to two longitudinal Z-iron pieces, which form the base of the motor, and are fixed to the frame of the fire engine in the position usually occupied by the boiler. The electro-magnet cores are of wrought iron, and are bolted to horizontal wrought iron pole-pieces, the lower one being screwed to the Z-iron frames. The bearings are in halves, and are supplied with sight feed lubricators.

The rotary pump is of the double gear type of Merryweather's patented pattern and is entirely of gun-metal. The pump is kept tight by elastic packing in grooves, and glands are dispensed with on the shafts by cup-leather packings and a special arrangement of passages, passing any leakage back into the suction side of the pump. A long flexible suction pipe four inches inside diameter is carried round the engine, always attached to the pump ready for immediate use. The delivery outlet is provided with a valve and lever so that either of the two outlets may be closed as required. The pump is driven by helical gear at a reduced speed of about one to three from the motor, and the intermediate gear of the pump, which is fitted on both ends of the shafts, is cut in steel.

For connecting the fire engine on to the electric mains, a Siemens' flexible concentric cable is carried round the engine in about 20 foot lengths. The internal and external conductors at one end of the first length are respectively connected to the terminals of the motor through the necessary resistances, and the controlling switch which are inclosed in a mahogany box with suitable doors to give access for oiling, etc. The other end of this length is connected to a half-union, either for attachment directly to the mains, which operation will be presently described, or to be prolonged by the addition of other lengths, each of which is supplied with couplings until the required amount of cable is obtained.

Experiments made with the fire engine by Messrs. Siemens Brothers are collected in the table below:

EXPERIMENTS WITH ELECTRICAL FIRE ENGINE.

Watts Expended.	Gallons of Water p'r Minute	Pressure in Pounds per Sq. In.	Size of Nozzle, Inches.
27,500	120	170	$\frac{5}{8}$
20,700	160	125	$\frac{3}{4}$
16,500	180	100	$\frac{7}{8}$
12,800	190	70	1

In order that electric fire engines may be operated at any point in the district supplied by electricity, Messrs. Siemens Brothers & Company fix near each hydrant a pillar, or if more convenient, a wall box. Each is connected with the mains by two insulated conductors, which are brought up and connected respectively to two concentric tubes by means of terminals. The inner tube is turned out conically at its outer end for the purpose of receiving the corresponding plug when the fire engine is to be attached, and connection is at the same time made with the outer tube by means of a corresponding split tube which slides over it. When not in use a water-tight gun-metal cap is screwed into position, and is secured to the pillar, or wall box, by means of a chain.

The inner conductor is in connection with a conical shaped plug of metal which fits accurately the inner tube in the post. The outer conductor terminates in a split tube so that when the union is screwed home the tube springs open and makes good metallic contact with the tube. Each conductor is thoroughly insulated, and the union is held in position by means of a gun-metal ring which is provided with lugs. On the arrival of the engine the fireman has simply to unscrew the cap and connect up the concentric cable in the manner described, and the engine is ready for use.—*Engineering.*

Fire in Boston Electric Light Company's Station.

The Ferdinand Street station of the Boston Electric Light Company was burned on the 22d inst., involving a loss of upward of $150,000. Six men in the employ of the company were in the building, but escaped unhurt. The insurance on the plant amounted to $108,000.

PRACTICAL NOTES ON THE REFLECTING GALVANOMETER AND ITS ACCESSORIES.

BY J. D. BISHOP.

XVI.

KEYS AND OTHER ACCESSORIES.

If you buy a second-hand galvanometer you will in all probability be able to get the necessary switches and keys of foreign make which go with it. Their styles vary so much that it would be impossible to give information which would meet every one. But they are generally illustrated and described in text-books, and Kempe, I think, has all that are of any good, and gives very plain and concise directions for connecting them up and using them. But when you buy a new galvanometer outfit you will find the keys and other accessories a very expensive part of it, and as you will have no extraordinary delicate work to do there is no reason for incurring the outlay.

The keys in Kempe are refinements only necessary when doing standard work, or work on long submarine cables, and you will arrive at just as good practical results for your work with the keys described below. Still, if you can get them you had far better do so, for a faulty key is worse than useless. See that whatever key you buy is well insulated, and that if mounted on circular hard rubber pillars the pillars themselves are screwed into the base and not fastened by a brass bolt passing through them from top to bottom, which offers no better insulation than if the brass parts of the keys were laid directly on the base. It has become the fashion of late to corrugate the surfaces of insulating pillars by turning horizontal grooves in them. There is nothing to admire in this. The object of the grooves is to increase the surface distance between the two parts insulated. It certainly does this, but not to any extent worth the sacrifice of appearances and cleanliness. Dust and damp will, in spite of all care, deposit and accumulate in the base of the grooves. It is not easy to dislodge it, and difficult to get the finger round and between the pillars and the other parts. It is better to have a plain, smooth, clean surface, and if the pillars are "petticoated" nothing can be more perfect.

If you only buy a galvanometer and provide your own keys and accessories you will require the following:

Two battery switches; 1 reversing key or switch; 1 short circuit key for galvanometer; 1 battery key for galvanometer; 1 pair line terminals.

BATTERY SWITCHES.

Peg switches are best, but lever switches are cheapest, and if kept dry and free from dust will do as well. The number of contacts or points will depend on the nature of your work. You should have a switch for your conductivity test battery of five contacts so as to put on 1, 2, 3, 4, or 5 cells at will.

You will also require one for your testing battery. The more contacts this has the more convenient it will be, and the more easily will you be able to extend the range of your work. You will find 10 points for 1, 2, 3, 4, 5, 10, 50, 100, 150 and 200 cells very handy. Barrett's chloride of silver 50-cell batteries require no points for anything under 50 cells, for the battery is provided with a commutator and plug and socket connections whereby any number of cells may be thrown in at will. Until you have become familiarized with your work, however, you had better provide a 10-point switch for your Leclanches, for if improperly treated the silver cells are easily ruined and their repair and renewal is an expensive item.

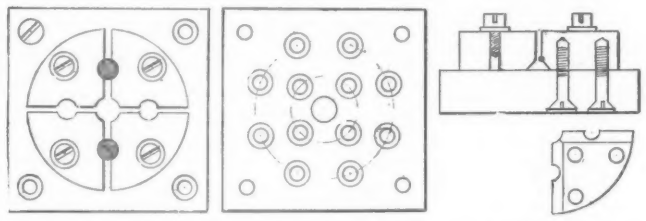
REVERSING KEY.

As its name implies, the function of this key is to enable the operator to reverse the current at will and for as long a period as required. But a good key is expensive and difficult to get, whilst a badly made one will be a constant source of worry and trouble. The best substitute for a key is a quadrant peg switch, shown in Figs. 1, 2, 3, 4. It should be well made and rigidly fastened together. If you cannot get a good one, you will find it better to make one than to worry with an inferior makeshift. This is not a difficult matter if the following instructions are observed, in which the few details not enlarged upon will be easily supplied by the intelligence of the reader:

Provide a solid brass disc two inches in diameter and one-half an inch thick and turn it true in a lathe. Score its surface with two lines at right angles to each other and thereon drill and taper four holes, one on each intersecting line, as shown in Fig. 1. These holes are to receive your pegs, but, as pegs are not easy to make, it will be better to have the taper made to fit the pegs of your bridge set, of which there will always be two or three available. Bore and tap also four other holes to receive square-headed machine screws, which, with washers, will serve for your connections to lines and battery, Fig. 1.

Now provide a base of hard rubber nicely planed, if possible, two and a half inches square by half an inch thick, and by means of your four connection screw holes fasten it firmly and centrally to the brass disc. Then drill 12 holes, as shown in Fig. 2, through the bottom of the base and into, but not through, the disc, which is to be tapped to receive screws, Fig. 3, by means of which the two are rigidly bound together, and the four screws put in at first in front are then withdrawn. Now mark both base and disc with a centre punch, so that when removed they may be returned to their original positions. Remove the disc and with a circular saw divide it into four quadrants, cutting the diameters of the taper holes, then chamfer off the straight edges of each quadrant, as shown, and replace them on the base, Fig. 4.

Screw them all on firmly and you will have a good solid peg switch. A little lacquer applied to all the surfaces except those of the taper holes will improve its appearance. If no lacquer is available, apply a little thin shellac varnish after slightly warming the



FIGS. 1-4.—THE REFLECTING GALVANOMETER—VIEWS OF QUADRANT PEG SWITCH.

pieces. Battery or other peg switches may be also made in a similar manner by providing a slab of brass of the required dimensions, drilling the taper peg holes first, then fastening it to its base and drilling its other holes, removing it therefrom and cutting it up with a saw through the line of the taper holes in sections as required. Although not absolutely necessary it is an improvement to drill a hole through the rubber base somewhat larger than the taper hole beneath each one. This offers an escape for accumulated dust and dirt when the switch is cleaned, and also allows the free descent of the peg.

In using the battery reversing-peg switch Fig. 1, it is scarce necessary to point out that the two battery leads are led to opposite segments of the switch, and the galvanometer and ground lines are led to the other two segments which separate them. Care must be taken to put the pegs in their proper holes or the battery will be short circuited. In order to avoid such an accident the two brass pegs are sometimes mounted on one piece of rubber, a modification which renders misplacement absolutely impossible, and is on other grounds to be strongly recommended.

GALVANOMETER SHORT CIRCUIT KEY AND BATTERY KEY.

There is really no absolute necessity for a short circuit key to the galvanometer, for the short circuit plug of the shunt box may be used as one, but the conveniences and advantages of a key over a plug are so great that one may be considered as nearly indispensable.

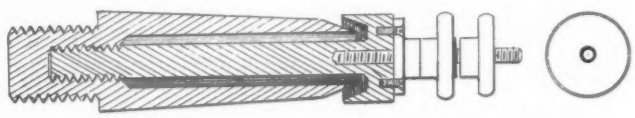


FIG. 5.—THE REFLECTING GALVANOMETER—SECTION AND END VIEW OF LINE TERMINAL.

Both short circuit key and battery key are easily obtained from any of the good supply stores. They should be Morse keys with back contacts. The lever and front and back stops should be in three distinct pieces, the separate parts well and substantially made and mounted on hard rubber bases.

If you cannot get keys in three pieces, then you may be satisfied with keys with all three pieces mounted on one metal base, as they are usually made, having the back stop insulated from the metal base by a hard rubber sleeve and collar. Although this is sufficient insulation for telegraph purposes, it is not so for galvanometer work, but requisite insulation may be secured by first mounting the whole key on a base of hard rubber. Then remove the key and cut away half an inch of the metal base, between the lever and back stop, right across the key at right angles to the lever.

The same may be done with the front stop. The pin which goes down through the metal base with a binding post on the end for both front and back stop, may now be threaded and provided with a nut and washer, so as to screw the stop firmly down on the hard rubber base. A couple of screws driven into the hard rubber base through what is left of the metal base of the key, will hold the lever part firmly in place.

The platinum contacts with which these keys are usually provided are made of too fine a wire, about No. 18 or less. Have them removed and replaced by stout contacts of No. 14 platinum wire, or the same end may be secured by carefully flattening down the original fine wire so as to give a good broad contact.

This also serves the purpose of rendering the adjustment of the contacts a more easy matter than if the fine wire were left untouched.

These two keys should be mounted on the same board—if on the same rubber base so much the better—and in such a manner that the two finger rests or buttons are about an inch apart, so that the first finger may depress the battery key and the second finger be used for opening the galvanometer by short intermittent touches.

The galvanometer short circuit key is connected across the galvanometer through the lever and the back stop, so that when the key is depressed the galvanometer is open.

The amount of depression required should be as little as possible, consistent with making good make and break contact, or time will be lost which is of importance in some tests, especially in capacity tests, where the charge should be sent through the galvanometer immediately it is discharged, for if any appreciable time is allowed to elapse between discharging and opening the galvanometer your test will be too low.

For discharge it is a good plan to put front stop of galvanometer key to earth, and the back stop to galvanometer between it and line terminal, whilst the lever, of course, goes between galvanometer and battery.

The discharge is thus put to earth in the smallest fraction of a second after the galvanometer is opened, for the same depression of the galvanometer key fulfills both functions.

LINE TERMINALS.

The leads from your galvanometer and battery should not only be well insulated throughout their length, but also at the ends where moisture and dirt are liable to accumulate, and the ends should terminate in a spiral coil containing three or four feet of wire and binding posts soldered to the wire.

This will reduce the handling and constant breaking of the wire resulting from repeatedly twisting the leads on to the cables. If you have a nice dry place a couple of brass terminal binding posts with two milled thumb screws each, one for the lead and the other for the cable to be tested, fixed about six inches apart on a piece of hard rubber will answer their purpose well.

But if your place is damp and steamy then petticoated pillars must be used. The easiest way of making these is to turn them out of hard rubber and fix a double thumb nut binding screw on the top. The accompanying sketch is copied bodily from Kempe's admirable hand book of testing, and there is no way of improving it or making a better one. (Page 282.)

These line terminals may be any reasonable distance from the testing room and placed so that what you have to test may be easily brought up to them, but if they are more than a few feet away, the insulation and capacity of the leads must be measured and duly deducted from both constant and test deflections. Do not cover your leads up but leave them open and merely suspended by wooden cleats.

The lighting committee of Avon, Mass., has reported favoring the use of electricity for street lighting.

Everett, Mass., has voted to apply to the State Legislature for permission to erect and operate an electric light plant.

Pierce City, Mo., has voted $12,000 for the purpose of building and maintaining an electric light plant to be owned by that city.

The Care of Dynamo Belts.

When we consider the important part performed by leather belts in electric lighting stations it seems strange that there is no more said about them; perhaps it is because there is very little attention given them by engineers and dynamo men.

It seems that they are considered unworthy of attention, and as there are no complicated parts to require adjusting, nor anything liable to become disarranged, they are let alone to drag out whatever kind of an existence they may.

It is a very common thing to go into a dynamo room and find the belts covered with oil and dirt and the pulleys gummed up so as to make it next to impossible to tell of what material they are composed, or, if not covered with oil, there is liable to be a coating of dust on the belt, which has accumulated while the machine is standing still, which transforms it into a blackboard on which the dynamo man figures up his extra time for the week.

If the matter is mentioned to the man in charge, he remarks that "It does look pretty 'rocky,' but it can't be helped, and it does no harm;" but there is just where he is wrong, for it can be helped, and it does harm, inasmuch as the belt in going over the pulley at such a high velocity throws the dust off, and as a greater portion of it is of a magnetizable nature the magnetized parts of the machine attract it, and generally it goes into the end of the armature among the wires, and there it stays and imbeds itself when the armature cools and contracts after a long run, and it is impossible to remove it, and the results may be imagined.

When the belt is standing and the dust accumulates on it there is not much harm done, but the trouble occurs when it starts and begins to stretch, and then it is that the dry dust imbeds itself in the pores of the leather, and it stays there always, cutting and rotting the fibers, shortening the life of the belt, making extra work for the engineer, putting the company to unnecessary expense, and calling down vile wrath on the heads of innocent belt makers which should rightly be visited on the dynamo man.

If the engineer, says the *Stationary Engineer*, would take a few moments' time each day, while the engine is "warming up" and the belt moving slowly, to take a piece of dry waste and wipe the belt clean, and repeat the operation several times during each run, he would find, in a short time, that he has some very nice looking, shining belts, and something that will be a source of pride and credit to him, and it will also act as an incentive to greater efforts in keeping the floors clean and other things in better shape. And more, it will be seen that the dynamos and engines are much cleaner after a run than before the plan was tried. Of course, with perforated, link or cotton belts it is not so easy to keep things clean, but the application of a clean broom or brush, or even waste, will make a great improvement.

When a belt slips on a pulley it is not necessary to tear the life out of it with a tightener or pour rosin on it by the quart until everything in the room is covered with it and sticky, for such treatment only injures the belt and, in the first case, makes the boxes heat. The same results may be obtained if the tightener is adjusted slowly until the slack is out of the belt and then a little beeswax rubbed on the face of the pulleys. Beeswax applied in this way has as great adhesive qualities as the rosin, gives a soft, smooth, pliable surface to the belt and prevents its cracking. A nice, clean belt will do better work, fill an engineer's heart with joy and pride, and it is easily obtained. Try it.

Springport, Mich., wants electric lights.

Fowlersville, Mich., is to be lighted by electricity.

Somerset, Pa., will have her streets lighted by electricity.

Leslie, Mich., is agitating electric lighting for her streets.

An electric light plant for the Cleveland, O., infirmary is decided upon.

St. Charles, Ill., will soon decide as to putting in an electric light plant.

Boston's Electric Lighting Companies.

The forthcoming report of the commissioners of gas and electric lighting will call attention to the companies which supply the citizens of Boston with electric light and power, says the *Boston News Bureau*. Foremost among these, because of its contract with the city, is the Boston Electric Light Company. The report soon to be published will give its condition June 30 as follows:

ASSETS.

	1891.	1890.	Inc.
Real estate	$336,786	$324,125	$12,661
Steam plant	228,510	217,903	10,607
Electric plant	299,907	268,553	31,354
Lines, meters, lamps and globes	744,330	648,107	96,223
Due for light and power	29,017	25,578	3,439
Fuel on hand	13,549	12,265	1,284
Materials on hand	21,582	24,116	*2,534
Office furniture	1,661	2,161	*500
Sundry accounts	2,282	4,501	*2,219
Cash	10,120	5,309	4,811
Total	$1,687,744	$1,532,618	$155,126

LIABILITIES.

	1891.	1890.	Inc.
Capital stock	$1,076,000	$1,000,000	$76,000
Bonds issued	300,000	291,000	9,000
Notes payable	88,078	56,783	31,296
Unpaid bills	28,396	24,135	4,261
Interest due, not paid	6,051	5,894	157
Balance profit and loss	189,218	154,806	34,412
Total	$1,687,744	$1,532,618	$155,126

PROFIT AND LOSS ACCOUNT.

Credit items:	1891.	1890.	Inc.
Balance brought forward	$154,806	$105,821	$48,985
Net earnings	123,797	133,767	*9,970
Rents	3,252	1,459	1,793
Premium on bonds sold	720	.....	720
Jobbing account	3,799	8,217	*4,418
Total	$286,376	$249,265	$37,111
Debit items:			
Dividends declared	$64,280	$60,000	$2,280
Interest paid	22,128	19,759	2,369
Paid leased companies	12,750	14,700	*1,950
Balance carried forward	189,218	154,806	34,412
Total	$288,376	$249,265	$37,111

*Decrease.

Since the report was prepared the capital has been further increased $181,800, making total outstanding January 1, 1892, $1,257,800. The capital authorized by the charter is $3,000,000, but by stockholders votes so far only $1,500,000 has been authorized. Of this about $700,000 was issued in exchange for appraised real estate, rights, privileges, machinery and plant secured by the several amalgamations of the Brush, American, Merchants' and Citizens' companies, and the remainder was issued for cash expended in the plant.

The latest absorption was of the Citizens' Company, of East Boston, and the company's lamps are now being scattered from Chelsea bridge to Mattapan. The company now supplies between 500 and 600 customers including the city of Boston. There is no permanent contract with the city, but by agreement from month to month the service is performed for 40 cents per lamp per night. Stock of the company was recently sold by auction at 104 ex-dividend. The latest previous sale quoted at 82 is believed to have been a fictitious transaction, as no stock changed hands. The stock is principally held in Hartford, Conn., and is very closely held. The officers are: F. A. Gilbert, Brookline, president; Hugh O'Brien, Boston, vice-president; S. S. Sias, Cambridge, treasurer; D. N. Richards, Isaac Fenno and Wm. Butterfield, Boston, Edward B. Maltby, Taunton, H. S. Hyde, Springfield, and James English, New Haven, directors. The light and power is manufactured under the Thomson-Houston system, and the bulk of the business is supplying arc lights.

The Edison Electric Illuminating Company operates under Edison system and reports its condition June 30 as follows:

ASSETS.

	1891.	1890.	Inc.
Balance brought over	.....	$17,901	
Real estate, steam plant, electric plant, lines, meters, lamps, globes, patent rights	$1,728,607	1,180,521	$548,086
Due for light and power	41,398	29,638	11,760
Materials on hand	61,021	43,061	17,960
Sundry accounts receivable	2,607	906	1,791
Cash	189,843	9,680	180,163
Notes receivable	41,698	186,032	*94,333
Total	$2,065,268	$1,417,727	

LIABILITIES.

	1891.	1890.	Inc.
Capital stock	$1,263,500	$1,160,000	$103,500
Bonds issued	703,000	150,000	553,000
Notes payable	10,000	35,000	*25,000
Unpaid bills	11,419	47,139	*35,720
Reserve fund	.....	12,000	*12,000
Depreciation fund	39,000	.....	39,000
Bills payable	29,672	13,587	16,085
Balance profit and loss	8,676		
Total	$2,065,268	$1,471,727	

PROFIT AND LOSS ACCOUNT.

Credit items:	1891.	1890.	Inc.
Balance brought forward	.. .	$5,913	
Bal. El. Mfg. acct. (net earnings)	$132,758	82,796	$49,962
Balance carried forward	.....	17,901	
Debit items:			
Balance brought forward	17,901		
Dividends declared	63,800	12,500	51,300
Interest paid	13,255	12,111	1,144
Construction charged off	2,124	70,000	*67,876
Carried to reserve	.....	12,000	*12,000
Depreciation	27,000	.....	27,000
Balance	8,676		

*Decrease.

The company has two plants in operation in Boston, the first at 3 Head Place the other on Hawkins and Bowker streets. A third plant is nearly completed on the water side of Atlantic avenue, between Oliver and Pearl streets, which will be larger than the other two combined, and one of the largest light and power manufacturing houses in the country. Its immediate capacity will be 10,000 horse-power, with a possibility of increase to 25,000 horse-power.

The company now supplies about 2,600 customers, including about 250 arc lights. It sells more power than any station in the United States. The power is utilized for every conceivable purpose, from turning a jeweler's lathe to the tremendous machines of the Electric Forging Company. The stock is held very closely, and has all been taken

FIG. 1.—SCHOENBERG'S ANNUNCIATOR RESET.—SHOWING DROPS DOWN.

at par. The Edison General Electric Company (the parent company) owns 3,179 shares, 69 Massachusetts stockholders own 7,316 shares, and eight people outside the State own 2,140 shares, all of which have been paid for in cash at par. The officers are: Jacob C. Rogers, president; W. C. Balies, vice-president; C. L. Edgar, general manager; W. W. Gooch, clerk; Hubbard Breed, treasurer; W. Powell Mason, T. Jefferson Coolidge, Richard D. Rogers, Geo. S. Silsbee, C. H. Coster and F. S. Hastings, directors. The two last named are officers of the Edison General Electric Company.

Schoenberg's Pneumatic Reset for Annunciators.

Mr. Ralph Schoenberg, of 129 East Sixty-second street, New York, has invented and patented the pneumatic reset for annunciators shown in the accompanying illustrations. It is simple, durable and powerful, and can be applied to any annunciator, new or old. All fallen drops can be instantly reset from any distance up to 250 feet.

The apparatus consists of a flexible bulb, a line of tubing and a pneumatic bellows, the latter placed within the annunciator case and connected to the tubing. All the cross shafts for raising the annunciator drops are connected to one perpendicular rod, which terminates at its base in a circular plate resting on top of the pneumatic bellows. The air is expelled from the bellows by automatic contraction and the weight of the rod resting on it. In this position one or all the drops are free to fall. The drops are raised or reset by inflating the bellows, which is done by pressing any one of several of the flexible bulbs which may be connected with the bellows.

These flexible bulbs may be located within easy reach of the annunciator or at a distant point, if desired. For offices and houses this reset is especially valuable, for if the flexible bulb be pressed before the annunciator is operated a blank annunciator is assured, and two or more signals will not appear at once. The inventor also claims that by the use of this reset the life of the annunciator adjustment is considerably prolonged, for the reason that the resetting pressure is always mild, steady and constant, and the adjustment is not subjected to the uneven racking incident to a hand lever reset.

Several supply houses have secured subagencies for Schoenberg's reset, The E. S. Greeley & Company, New York, being sole agents.

An Electrical Fog Bell.

The port of Ravenna, in the Adriatic, has recently been provided with a fog bell, the invention of the Abbé Ravaglia, and worked by electricity. It is situated at the end of the mole leading into the harbor, and the current is conveyed to it from a battery in the light-house, about a kilometer distant. The apparatus for striking the bell consists of a magneto-electric motor planted in the bell tower and connected to a mechanical puller. When the current from the battery passes through the armature of the motor the motion of the armature is caused to turn a disk having pins projecting from its border. These pins catch on the end of a pivoted lever as the disk revolves, and by raising one end of the lever depress the other, thereby pulling the bell chain and making the hammer strike the outer rim of the bell. A rapid series of strokes is the result, and the loud continuous note is heard for a long way. The battery employed is the constant form of Daniell, and a galvanometer is kept in the circuit to show that the current is of proper strength. A telephone circuit also enables the attendant at the light-house to hear the "drone" of the motor and thus know whether it is working at its proper speed. Such an apparatus is, under certain circumstances, cheaper, simpler and more convenient than a steam siren or a bell actuated by the waves.—*London Times.*

The Double Carbon Arc Lamp.

The Brush Electric Company, of Cleveland, Ohio, has issued the following circular: We have heretofore called attention to the decisions of various courts upon the validity of the double carbon lamp patent, owned by this company, by notice in electrical and other papers and magazines, and in many instances by letter. Many suits have been begun and decisions rendered in favor of this company in the courts of the United States of the different circuits, including the districts of Indiana, Illinois, Ohio, California and New York, and suits against both infringing manufacturers and users in these and other districts are now pending.

Ample time and opportunity has now been given the users of infringing double carbon arc lamps to cease such use, and we do not think that any manufacturer would now care to attempt to engage in the production of a double lamp without very careful consideration as to the result of so doing. In the event of such continued use (or attempt to manufacture), it will be necessary for us to take proper action to prevent the same, and this, not so much for the reason that we have any great advantage to ourselves in stopping such present use, as the very ap-

FIG. 2.—SCHOENBERG'S ANNUNCIATOR RESET.—RAISING THE DROPS.

parent fact that such use has, and is encouraging others in commencing the infringing use of double arc lamps, and continuing the infringement.

This company was the first to manufacture arc lamps for use in series, and, besides the double lamp patent, is the owner of other foundation patents, which cover any possible use of arc lamps in series, and which it was enabled to acquire by reason of its early work and experience. Suits are now pending upon these latter patents and adjudications thereon should soon be had. It is therefore proper to call attention to this situation for many reasons which must be apparent. Respectfully,

THE BRUSH ELECTRIC COMPANY.

Monte Vista, Colo.—The Amethyst Water Works and Electric Light Company; capital, $100,000. Promotors, G. P. Wilson, E. W. Eversole, W. B. Manderville, E. J. Renner, J. McArthur, J. Hecker, J. D. Naben, W. W. Reilly, G. W. Southery, Thos. Eversole.

Charter, O.—The Westmoreland Electric Company; capital, $50,000.

Logan O.—Logan Electric Light Company; capital, $20,000.

New Whatcom, Wash.—B. B. Electric Supply and Construction Company; capital, $1,000.

Chicago, Ill.—Colby Specialty Supply Company; capital, $100,000. Incorporators, Edward J. Colby, Albert J. Fisher and Harry Fox.

Fountain, Colo.—Rock Creek Toll Road and Telephone Company; capital, $5,000. Incorporators, Alvin Ames, T. B. Mitchell and A. M. Worton.

Louisville, Ky.—Louisville Electric Company; capital, $25,000. Incorporators, Henry F. Donigan, John W. Dawson and Joseph Meyrick, Jr.

Stockton, Cal.—Stockton Electric Railroad Company. Directors, I. S. Bostwick, Joseph Fyfe, E. R. Hedges, H. J. Corcoran and S. D. Woods. Capital, $500,000.

Parkersburg, W. Va.—Home Lighting and Fuel Company; capital, $250,000. Promoters, B. D. Spillman, J. A. Wetherells, J L. Bushley, all of Parkersburg, W. Va.

Castle, Mont.—The Castle Electric Company; capital, $50,000. Incorporators, John L. Fraser, Hanson H. Barnes, Nathan T. Dinsmore, George R. Simon and Charles E. Miller.

Austin, Tex.—The Paris Electric Light and Railway Company; capital, $300,000. Incorporators, S. J. Wright, John J. Walsh, John Martin, D. H. Scott and S. J. Baldwin, Jr.

Troy, N. Y.—National Storage Battery Company; capital, $5,000. Directors, W. H. Hollister, Jr., Edgar G. Bernard, W. D. Weaver, George W. Daw, W. H. Hollister, Clinton M. Ball and E. B. House.

Doylestown, Pa.—The Doylestown Electric Company. Incorporators, Alfred Paschall, Robert M. Yardley, Albert F. Scheetz, John Pollock, John D. James, Henry S. Murfit and Henry Lear.

Wilmington, Del.—The Chicago Electric Wire Company, of Delaware; capital, $50,000. Incorporators, William Weightman, of Philadelphia, and Henry B. Cobb and Winfield S. Brown, of Wilmington.

Everett, Wash.—Everett Terminal Company; capital, $500,000. Promoters, Wyatt J. Rucher, Bethel J. Rucher, of Tacoma, Wash. Incorporation papers sent to B. S. Grosseup, Fidelity Trust building, Tacoma, Wash.

Pen Argyl, Pa.—The Pen Argyl Electric Light and Power Company; capital, $10,000. Promoters, John S. Jackson, C. J. Fitzgerald and Henry E. Stephens. Incorporation papers sent to N. D. Chace, Pen Argyl, Pa.

Logan, O.—The Logan Telephone, Water and Light Supply Company; capital, $25,000. Promoters, S. H. Bright, M. D. Moore, N. W. Hamblin, W. D. Mansfield and Wm. P. Price. Incorporation papers sent to Wm. P. Price, Logan, O.

Somerset, Pa.—The Somerset Electric Light, Heat and Power Company; capital, $12,000. Promoters, G. B. Hough, A. W. Knepper and J. A. Berhey, all of Somerset, Pa. Incorporation papers sent to Valentine Hay, Somerset, Pa.

Apollo, Pa.—Apollo Electric Light, Heat and Power Company; capital, $20,000. Promoters, George G. McMurtry, Allegheny, Pa.; Wallace P. Bache, Pittsburgh, Pa., and James S. Whitworth, Apollo, Pa. Incorporation papers sent to James S. Whitworth, 115 Warren avenue, Apollo, Pa.

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Boston is talking of a municipal electric lighting plant. Whew!

Interest in the Buffalo meeting of the National Electric Light Association is growing apace. This meeting will undoubtedly be of a most practical character, and the central station man who misses it will have reason for regret.

Mayor Boody, of Brooklyn, as we intimated in our last issue might be the case, has failed to act upon the aldermanic resolution granting the right to use the trolley to the street railways, and the same became a law, subject to the approval of the State railroad commissioners. Their approval has been obtained and work will be commenced in the early Spring by the railway companies to construct their lines and establish power stations. And so ends the big fight in Brooklyn. Prejudice and ignorance get whipped every time in these days of electric enlightenment and progress.

The World's Fair fakir has arrived, and we shall soon be deluged by accounts of the most illusionary and vividly bewildering electrical schemes conceived by man.

The marvelous adaptability of the power of electricity to intricate processes is nowhere more apparent than in the Hollerith electrical tabulating apparatus exhibited before the New York Electric Club last Thursday night. This is a truly wonderful invention, saving time, money and annoyance, and working out surprising results, accurate to within one-tenth of one per cent.

A very large amount of capital has been invested in the South within the past few years in electric lighting, power transmission and electric railways with very satisfactory returns. The spirit of enterprise and progress has taken firm root, and from all present indications this section will continue to absorb a large percentage of the output of the electrical manufacturing concerns of the country. The Spring will, no doubt, open up a very large trade in the South for electrical products.

There is a most decided need of better facilities of communication with our exposed lighthouses and lightships during severe stormy weather. There have been numerous wrecks along our coast owing to the dislodgement of lightships, and disastrous losses of life which might have been greatly reduced had it been possible to telegraph to the mainland for assistance. The present method of communication during tempestuous weather, when danger of shipwreck is greatest, is most unreliable, and in many cases it is impossible to make use of it at all. The government should take this matter in hand and establish telegraphic communication by cable. That it is entirely feasible has been proven by past and recent experiences with cables in exposed places, and that it is important goes without the saying.

The long distance telephone lines are being rapidly extended to the principal cities of the country, and trunk lines are being built to connect the metropolis with the great centers of trade. Notwithstanding the high tariff rates the lines already built are in constant use, which is proof that the advantages gained are considered worth the cost. This service will undoubtedly grow in popularity as its facilities are increased, just as that of the local telephone did and will eventually absorb many of the channels now controlled by the telegraph. Press news can be more expeditiously sent by the telephone, and the day is not far distant when that instrument will be the principal medium of its transmission. Manufacturing concerns are connecting their factories with their city offices with a great saving, in the long run, in time, accuracy and annoyance, which mean money. There are a thousand and one lines in which the telephone has the advantage of the telegraph, and it is only a question of time when the latter will be displaced by such service.

A paragrapher in a New York daily paper has started his literary efforts for the new year with this:

Telegraph and telephone girls about New York offices are as plentiful as sparrows in Spring, and their market value is only $3 a week. And yet the poet sings it is good to be alive! In some place other than a great city like Gotham.

The female employés of the telephone company in New York make wages averaging between $6 and $7 per week. Their work has no unhealthful features and there is no better cared for class of employés in the world. The same is true of the girls employed by the telegraph companies in this city, although in not quite so marked a degree. As for telephone attendants in business offices, we think the paragrapher would better try to employ one for $3 a week. He would certainly be able, with her assistance to obtain more accurate information. The idea of employing a telegraph operator in a business office for $3 a week is, of course, not to be seriously considered.

PROSPECTS.

Business in the electrical field, as in all others, has, during the past month, shown little activity, being confined principally to finishing out the remaining contracts of the old year, mending fences, and making preparations for the Spring trade. In fact, the month of January has not differed much from its predecessors of former years. From all present indications we feel safe in predicting a very large business for 1892, and, indeed, this is, as far as we can learn, the prevailing opinion, even among the most pessimistic. The Winter crops have been abundant, there is a very large surplus of money awaiting investment, there are many more miles of railway projected, judging from the orders for steel rails already placed, than there has been for the past three years, and a healthy feeling of confidence has very largely replaced the distrust of most investments which has existed for over a year. More electrical work is projected in the fields of lighting, power transmission and traction than ever before, and the general scope of the application of electricity to general commercial purposes has broadened quite materially.

It looks very much as though business in general would now have the benefit of a most decided reaction from the more or less depressed or fluctuating conditions that have prevailed so long. Competition in the electrical field has taken on a much more reasonable aspect and business is being conducted on a more conservative and satisfactory basis. The number of dividend earning central stations is increasing every day, and we find the coal pile more carefully considered, which, together with the introduction of the more improved and economical forms of machinery, cannot fail to produce their natural result. We do not wish to appear too oracular or sanguine, but we would not be surprised to see a big boom in trade during 1892.

The use of electricity for motive power over railroad trunk lines is now obtaining such favorable consideration from railway managers and experts, that its general adoption would seem only a question of a short time. This we recently predicted and we feel confident that when the start is made the change from steam to electricity, for moving railroad trains, will be as phenomenally rapid as has been the displacing of horses for street car service. Railroad managers are proverbially progressive and wide-awake, and that they are fully alive to the importance of this subject is shown by the action of the Illinois Central regarding its suburban lines about Chicago, mentioned in a recent number of the REVIEW, and the investigations of the commission of nine railroad experts now being made and which are noted on another page of this issue. The immense field of the application of electric power is swiftly opening up, and the dreams of the enthusiast of a short time ago are rapidly becoming simply every-day facts.

The Trades League, of Philadelphia, which was organized a short time ago in the interests of the city, is working with a very commendable spirit to aid the Bell Telephone Company in providing a better service. This company has, it is stated, been hampered in its endeavors to place its wires underground by harassing delays in granting the requisite authority, and the Trades League, although not organized in the interests of the telephone company or any other corporation, is endeavoring to aid in bringing about a more favorable state of affairs. Surely a disposition on the part of the company, so evidently in the interests of a better service for Philadelphia, should have the prompt and generous recognition which it deserves and which it has received in other large cities of the country.

One of the many important, but often neglected details of the work in an electric light or power station is the care of belting. Some engineers and dynamo tenders have an idea that a belt never requires attention. Belt manufacturers have here a large field for instructive missionary work.

CORRESPONDENCE.

OUR LONDON LETTER.

Nimes.—At Nimes, in France, Messrs. Ferranti have just completed the electric lighting station and are supplying current to 6,000 lamps.

Cannes.—The new electric lighting plant has given every satisfaction, and it has now been ordered by all the leading hotels, and is to be supplied by the Société de Lumière Electrique.

Laing, Wharton & Down.—The head offices of the Laing, Wharton & Down Construction Syndicate have been removed from 82a New Bond street, London, W., to 38 Parliament street, Westminster, S. W., where all communications should in future be addressed.

Are Telephones to be Government Property?—The example set by the Plymouth chamber of commerce has now been followed by the Halifax and Bedford chambers, who have proposed resolutions calling upon the government to buy up the telephones of the country.

Frankfort Exhibition.—The managing committee, after payment of all expenses, report a surplus of 152,000 marks. The town of Frankfort and its chamber of commerce receive back their guarantees, and to the exhibitors will be repaid a large part of their expenses for space and motive power.

"L'Industrie Electrique."—I have been favored with a copy of the first number of this journal, of which M. Hospitalier is editor-in-chief, and which will be a review of electrical science and its industrial applications. It will be published on the 10th and 25th of each month, and should prove thoroughly successful.

Irish Notes.—The lord mayor of Dublin in reviewing the work of the past year to the town council on New Year's day, intimated that the central station building for the electric installation would be completed in about a fortnight. The principal streets would be lighted in May and the corporation would be prepared to supply current to private consumers in July. The laying down of the street mains is being carried out by the Irish House to House Company, while the generating plant is in the hands of the Electrical Engineering Company, of Ireland.

Personal.—At the beginning of the new year it is customary for the Queen to confer some titles and honors on those whose services have been deserving. Among the list for this year, electricians with be honored to find that a peerage has been given to Sir William Thomson. It is probable, according to the *Times*, that he will take the title of Lord Kelvin, deriving it from the name of the beautiful river flowing past the college grounds in Glasgow, and on which his windows look out. It seems a pity that the name in which his great works have been done should be allowed to sink into forgetfulness.

"L'Electricien."—There have been several changes in the management of our French contemporary, and the editorial department is now under the supervision of the following gentlemen, all of whom are well known in the electrical world: M. Monnier, Professeur a l'Ecole Centrale des Arts et Manufactures; M. Eric Gérard, Directeur de l'Institut Electrotechnique Montefiore; M. Felix Lucas, Ingénieur en Chef des Ponts-et-Chaussées, Administrateur des Chemins de fer de l'Etat; M. Emile Dieudonné Ingénieur-Electricien; M. Eugéne Meylan, Ingénieur-Electricien; M. Montpellier, Fondateur de la *Revue Internationale de l'Electricité*.

CHARLES FFRENCH.

London, January 20.

OUR CHICAGO LETTER.

Mr. R. J. McCarthy, general manager of the Metropolitan Street Railway Company, Kansas City, Mo., was in the city this week.

Mr. W. R. Mason, manager of the Electric Merchandise Company, returned Thursday from a business trip to New York city.

Mr. W. W. Bean, president St. Joseph and Benton Harbor Street Railway Company, St. Joseph, Mich., is in Chicago this week, and will close contracts to change their entire road to electricity before his return.

Read the Special inducements in the next issue of the REVIEW offered by the Michigan Central Railroad Company to parties desiring to attend the National Electric Light Convention, to be held at Buffalo, N. Y., next month.

George Cutter has just returned from a trip to Boston, where he made arrangements to handle the Simplex braided rubber wire through a much larger territory, including nearly all of the States north of the Ohio river and east of the Rocky Mountains. He also secured the general Western agency for the new interior conduit known as "Buildite."

The Hyde Park Electric Light and Power Company's plant at Forty-first street, near Cottage Grove avenue, was burned to the ground Wednesday afternoon. The building is a one-story brick structure 50 feet square. It was badly damaged by fire only a few weeks ago, and the laborers were just finishing tarring the roof and erecting a large chimney when the fire occurred. The fire was caused by the explosion of a gasoline lamp in the waste room. Hoyt Burnett, the fireman, was badly burned about the hands in his efforts to extinguish the blaze. The loss will amount to $3,000, which is principally on three large dynamos.

The Chicago and St. Louis Electric Railway Company filed articles of incorporation in the office of the Secretary of State, at Springfield, Ill., this week. It is proposed to build a railroad from Chicago to East St. Louis, with branches to Belleville, Alton, Edwardsville, Carlinsville, Litchfield, Hillsboro, Taylorville, Springfield, Decatur, Clinton, Bloomington, Morris, Kankakee, Joliet and other places. It is further proposed to distribute electricity for heating, lighting and motive power. The principal business office is to be maintained at East St. Louis, and the capital stock is $1,000,000. The incorporators and first board of directors are: S. R. McBurner and A. C. Corper, St. Louis; A. C. Rhoades, Thomas May, Jr., and Walter E. Beckwith, East St. Louis.

Professor Barrett has been instructed by the council finance committee to prepare a report dealing with the question of extending the electric light plant for the purpose of lighting the boulevards leading to the World's Fair grounds, Jackson boulevard and other thoroughfares with electricity. Although no appropriation may be made this year for the extension of the city's plant, arrangements will be made with the quasi-public electric companies for lighting certain districts. It is understood that the South Park commissioners will establish a plant in Washington Park and erect the lamps and lay wires along Michigan boulevard to Thirty-fifth street, on Grand, Oakwood and Drexel boulevards, if the city will agree to maintain the plant, and in time agree to assume the responsibility for the cost of the plant. Professor Barrett has already furnished the South Park commissioners with plans for the work indicated. M. J. B.

Chicago, January 30.

OUR SEATTLE LETTER.

Anacondes is now lighted by electricity.

The Home Electric Company has put in a new engine to operate a 1,300 light dynamo.

On The Morning of January 21 a water main burst in the power house of the North Yakima Electric Light Company, and damaged the plant to the amount of about $500. A babe belonging to Engineer Spriesterbach was drowned.

The Town of Ballard is now lighted by electricity. The Ballard Electric Light Company has entered into a contract to furnish thirteen 2,000 candle-power lamps at $14 a month for each, and eight 1,200 candle-power lamps at $10 each.

The Seattle Gas, Electric Light and Motor Company has lost in its suit against the city for $100,000 damages for raising the grade on the street about the company's property. The jury held that the plant of the company is as accessible as before the change. The plaintiff has given notice of a motion for a new trial.

W. S. Leckie, the proprietor of a dry goods store, has brought action against the company to recover $37,025 for damages done by a fire last May. The plaintiff says that he entered into a contract with the company to light the store by electricity. The work of putting in the wires was improperly done, which resulted in the fire starting from one of the wires.

There Are Now 795 telephones in use in Seattle and about 770 in Tacoma. The lines are being constantly extended in all parts of the city and new poles are being erected. A new switchboard has been placed in the central office here, with three instead of two sections, so that 1,000 telephones can now be handled. Thirteen young women are now employed at the exchange.

The City has renewed for one year a contract for street lighting with the Seattle General Electric Company. During December this company stretched six miles of wire in the streets here. It has received a new 650 horse-power E. P. Allis engine. It is intended to keep in reserve in case any of the other engines break down and is arranged so that the dynamos can be switched on it in an instant. The company has added to its plant a 50 light Edison arc dynamo. This is the first Edison dynamo in the city, the others being of the Thomson-Houston make. The company is expecting two Edison dynamos that will carry 1,000 incandescent lights each.

Seattle, Wash., January 24. H. L.

OUR ALBANY LETTER.

Electric Lights have been placed in the Presbyterian Church at Whitehall, N. Y.

Mr. Charles Steinmetz is giving an interesting course of electrical lectures at the High School, Yonkers, N. Y.

The Fort Edward, N. Y., Electric Light and Power Company, Limited, has made the following report to the Secretary of State: Capital, $12,000, all of which has been paid in; assets, $12,000; debts, $2,200.

Senator Hogan has introduced a bill in the legislature, adding to the National Guard a signal and telegraph corps. Assemblyman Weed has introduced a bill permitting the lighting of Flatbush's streets with electricity.

A. J. Kasson, a prominent citizen of Gloversville, N. Y., local manager of the Postal Telegraph Company, died suddenly Thursday, of apoplexy. He was a public-spirited, charitable and enterprising man. He leaves a wife and sister.

The Following Members constitute the Assembly electricity, gas and water supply committee: Messrs. Martin, New York; Roche, New York; Kelly, Kings; Mullaney, New York; Cahill, Kings; Ryan, Westchester; O'Dair, New York; Deyo, Broome; Reid, Washington; Corrydon, Allegany; Patchin, Steuben.

The Steuben Street Line of the Albany Railway was opened this week. On board the first car to make the trip, No. 71, in charge of Motorman Brannigan and Conductor O'Connor, were General Manager McNamara, Electrician Sturges, Secretary James McCredie, Alderman Russ, Alderman Fleming, W. Dennin and John Smith. The return trip was witnessed by large crowds of people, who were anxious to see the motor ascend the hill, Steuben street being the steepest grade of any of the Albany Railway's lines. The first trip was entirely satisfactory.

The Following Bills have been introduced in the State legislature: Assemblyman Kelly, ranking bell-ringers in the Brooklyn Fire Department, acting as telegraph operators, with foremen. Senator Mullin, allowing street railways in cities of less than 20,000 to charge more than five cents for fare in certain cases. Assemblyman Woodbury, ratifying certain acts of the Dunkirk and Fredonia Railway Company. Assemblyman Rice, allowing the use of the Erie canal for experiments with various motive powers. Assemblyman Kelly, forbidding street railways on Ocean avenue, Brooklyn, changing their motive power except by consent of property owners. Assembyman Gorman, for a board of electric light commissioners in West Troy. L. M. W.

Albany, January 23.

OUR BOSTON LETTER.

Mr. James H. Mason succeeds his brother, Dr. A. F. Mason, in the general management of the Simplex Electrical Company, this city.

The Westinghouse Electric Company's system of electric propulsion will soon be in operation on the street railway at Burlington, Vt.

Mr. Thomas H. Hurley, representing Mr. C. S. Beardsley, receiver of the Empire City Electric Company, New York, favored this office with a visit recently.

The Massachusetts Electrical Engineers' and Mechanics' Association will give its second annual ball at Odd Fellows' Hall, this city, Tuesday evening, February 2.

The American Electrical Works, Providence, R. I., has been sending its friends a pretty calendar. This office was not forgotten, and the favor is appreciated.

Mr. Norman Marshall, president and general manager of the Star Electrix Company, Philadelphia, was among the prominent electrical visitors to the "Hub" this week.

Dr. A. F. Mason, formerly general manager of the Simplex Electrical Company, has joined partnership with Mr. A. C. Pond, under the firm name of Mason & Pond, No. 620 Atlantic avenue, this city.

The Westinghouse Electric Company has received orders recently from the Middlesex Street Railway Company, of Lowell, Mass., for large additions to the electrical equipment previously installed by the former.

Messrs. Westinghouse, Church, Kerr & Company, whose offices are at Boston, New York, Philadelphia, Pittsburgh, Chicago and San Francisco, have issued a pamphlet entitled, "Notes on Power Plants for Electric Railways and Electric Lighting." Write to the company for a copy.

Messrs. McKenney & Waterbury, manufacturers of electric and gas combination fixtures, this city, have been awarded contracts to furnish fixtures for the public library, at Lawrence, Mass., and the City Hall, at Lewiston, Me.

The Westinghouse Electric Company has closed a contract with Messrs. A. H. Hews & Company, pottery manufacturers, North Cambridge, Mass., for the installation of an isolated incandescent light plant—Westinghouse direct current system—which is to illuminate the entire works.

Electric Roads Active.—The electric street railways of Marlboro, Mass., Plymouth and Kingston, Mass., have petitioned the legislature for permission to extend their respective lines, and also request authorization to increase their capital stock, respectively.

Mr. J. Bradford Sargent, the New England agent for the Stirling Water-tube Safety Boiler, reports the following sales recently: Minneapolis Street Railway Company, 2,000 horse-power, and the Toledo, Ohio, Water Works 1,500 horse-power. The last named order was secured after competitive test with 20 different manufacturers.

The Thomson-Houston Electric Company has declared a dividend of $1 per share on the common stock, payable February 15 to stock of record February 5. It is reported that "an united exhibit at the World's Fair will be made by the various branches of the Thomson-Houston Electric Company, at an expense of $500,000." This exhibit will occupy upward of 20,000 square feet of space. W. I. B.

Boston, January 30.

President Chandler at the Electric Club.

President A. B. Chandler, of the Postal Telegraph Company, will lecture before the New York Electric Club the evening of February 12, on "Reminiscences of Lincoln." This is Lincoln's birthday. The lecture will be interspersed with war songs by the Brunswick Quartette.

OBITUARY.

We have to make the sad announcement of the death of Mr. Edwin S. Riggs, a director and assistant treasurer of The E. S. Greeley & Company, of this city, with which he has been associated for the past 12 years in the capacity of city manager and purchasing agent of the railroad department. His death took place at his residence in Brooklyn, No. 309 Lafayette avenue, where funeral services were held and the interment took place at New Haven, Conn., his former home, on Saturday, the 30th inst. Mr. Riggs was universally popular and will be greatly missed from the electrical fraternity.

National Electric Light Association.

The following letter is self-explanatory:

NEW YORK, January 28, 1892.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have received official notification from the Trunk Line Association, Central Traffic Association and Southern Passenger Association, stating that they have granted, from points in their territory, a fare and a third rate to Buffalo, on the certificate plan, to cover the time of our Convention.

Yours very truly,
C. O. BAKER, JR.,
Master of Transportation.

Secretary Porter has issued the following letter:

NEW YORK, January 29, 1892.

TO THE EDITOR OF ELECTRICAL REVIEW:

In compliance with the wishes of a majority of the members in regard to holding an exhibition in connection with the Buffalo meeting, it has been decided not to hold an exhibit under the auspices of the Association. This, however, will not interfere with any arrangements which individual members may wish to make for having a display of goods at the hotel, as has been the custom heretofore.

Very respectfully,
GEO. F. PORTER, Secretary.

PERSONAL.

Mr. Stephen E. Barton, of Boston, was a recent New York visitor.

Mr. D. B. Dean, of the Electric Merchandise Company, Chicago, is a New York visitor.

Mr. C. M. Morse, of the Buffalo Engineering Company, Buffalo, N. Y., visited New York last week.

Secretary E. I. Garfield, of the Thomson-Houston Electric Company, Boston, visited New York last week.

Prof. Leo Daft recently addressed a meeting of the National Association of Stationary Engineers, at Seattle, Wash.

Mr. Thomas Muir, late manager of the Ontario Car Shops, London, Can., has been appointed treasurer of the Detroit Electrical Works.

F. W. Cushing, formerly of the Central Electric Company, of Chicago, has been appointed the Western manager for Day's Kerite wires.

Mr. C. O. Baker, Jr., was in Buffalo the other day arranging transportation matters for the coming convention of the National Electric Light Association.

Mr. Van Depoele, of the Thomson-Houston Electric Company, is not yet out of danger, but is much more comfortable. He is one of the many victims of the grip.

Dr. F. A. C. Perrine, of the John A. Roeblings Sons' Company, was in Baltimore the other day relative to furnishing cables for the Baltimore City Passenger Railway lines.

Mr. C. H. W. Copeland, has been appointed New York agent for The John T. Noye Manufacturing Company, of Buffalo. He has taken offices in the Electrical Exchange building, 136 Liberty street.

Telephonic News

*** The telephone system at Racine, Wis., is to be rebuilt.

*** A long distance telephone is being established between Charleston, S. C., and Savannah, Ga.

*** The Wheeling, W. Va., Telephone Company is pushing for a subway franchise from the city fathers.

*** A telephone line has just been completed between Melbourne and Adelaide in Australia, a distance of 500 miles.

*** The Bell Telephone net output for the month ending January 22 was 1,397 instruments, as against 1,047 for 1890–91.

Good Showing of the Standard Underground Cable Company.

The board of directors of the Standard Underground Cable Company held their regular meeting at Pittsburgh last week, and declared a dividend of 1½ per cent. on the capital stock of the company, payable on February 10 prox., the transfer books to be closed from February 5 to 10 inclusive. There was a large representation of the stockholders, and the annual report of the vice-president and general manager, Mr. J. W. Marsh, on behalf of the board of directors, was followed with great interest. The business of the company for the year 1891 was very gratifying, having amounted to $518,677.27. The net earnings over all expenses for the year were $65,858.37, and the total surplus earnings or undivided profits of the company up to December 31, 1891, now amount to $369,213.50. During the year 1891 the company reduced its accommodation paper from $52,200 to $10,500, and in addition to this paid up all bills in full to December 1, besides having discounted a portion of the December bills. An interesting disclosure made by the annual report is that the interest and discount account on the books of the company shows a credit balance for the year 1891.

Owing to the financial depression which lasted almost through the entire year 1891, many new projects were abandoned and many old ones curtailed, thus vastly lowering the total possible business for the year and correspondingly increasing competition. Nevertheless, it is believed that the Standard Underground Cable Company secured a larger proportion of all the orders placed during the year 1891 than it did in the year 1890, and the net result of its operations in view of the financial depression and great decline in values during the year is a matter for congratulation. The company had 42 customers during the year 1891 whose purchases amounted to over $2,000 each, the entire purchases of the 42 aggregating $432,733.81; the total number of customers for the year was 305.

The largest electric light cable contract taken during the year (which was also the largest single order ever placed in the United States for this class of goods) was that of the Minnesota Brush Electric Company, of Minneapolis, amounting to over 425,000 feet of cable, the contract including the complete installation of the cables ready for connections to houses, stores, offices, street lamps, etc., and to convey currents at 500 volts potential for power purposes, 1,000 volts for alternating incandescent lighting, and 3,500 volts for municipal and commercial arc lighting. Other prominent customers were the Western Union and Postal Telegraph Companies and the Gold and Stock Telegraph Company, the most prominent telephone companies in the United States and prominent railroad companies.

The prospects are exceedingly favorable for greatly increased business in the year 1892, the contracts already estimated on since the first of January being about three times as large in the aggregate as they were a year ago; this fact, together with the favorable result of last year's business, leads the directors to express their entire confidence in the future of the company.

There was no contest and the old board of directors were re-elected as follows: George Westinghouse, Jr., Mark W. Watson, John H. Dalzell, James H. Whillock, John B. Jackson, George B. Hill, John Moorhead, Jr., Robert Pitcairn and Joseph W. Marsh.

ELECTRICITY 150 YEARS AGO.

BY DR. P. H. VAN DER WEYDE.

V.

Before closing the series of historical data which must be classed under the heading used, we ought to give some attention to a cognate branch of research longer known and of which the laws were better understood 150 years ago than those of electricity, namely, magnetism.

This is essentially necessary for the reason that it has a close relation to the very different kind of electricity discovered nearly 100 years ago, at the close of the eighteenth century, and named, after its discoverer, galvanic electricity. It is so different from the electricity only known until then, that many of those *savants*, who are always ready to invent different kinds of fluids for explaining peculiar phenomena, held that the galvanic fluid was of another nature than the electric fluid, and differed from it as much as this did from the magnetic fluid and from the other fluid called caloric.* The tendency of the minds of those who are foremost in the ranks of scientific pioneers is at present in the exactly opposite direction, and no electrician of high standing believes any more in an electric fluid, and is perfectly convinced that the electric phenomena are due to peculiar kinds of molecular and atomic motions, in the same way, but of a different mode from those which produce the phenomena of heat, as has been demonstrated by Rumford, Joule, Mayer, etc., and so ably been popularized by Tyndall in his excellent book entitled "Heat as a Mode of Motion."

Speculative details in regard to the nature of these different motions of the infinitesimal constituents of what we call matter are still premature and must be left to posterity; however, sufficient material is on hand for another book, which it is hoped that some investigator will publish by and by under the title "Electricity as a Mode of Motion," which does not mean as a motive power—that we have had long ago—but electric phenomena explained by different kinds of motions in material bodies. This will be a field for the application of the highest branches of mathematics and dynamics applied to infinitesimal quantities.

The cognate branch of research referred to, magnetism, was known before electricity was studied. It proved soon to be of more practical value than was the case with the first electric discoveries. The natural magnets found in some iron mines had, of course, early attracted the attention of investigating minds, and it was soon found that their mysterious attractive power could be imparted to iron and steel, while when freely suspended or floated they were found to take a certain direction in regard to the terrestrial poles and so proved that our whole earth has magnetic properties, in fact, was a colossal magnet. This gave origin to the compass needle, which made ocean navigation possible, and without which this continent might not have been discovered by Columbus. It is well known that the Mongolian race—especially the Chinese—used the compass long before it became familiar to the Caucasian race, and used it in the deserts of Central Asia as well as on the ocean.

In Plate Q, Fig. 1 represents a natural magnet with its armature, which consists of two flat soft iron plates applied against the poles of the natural magnet, which for the purpose of having a perfect contact together are ground down as well as the iron plates. These iron plates project below and attract the armature proper charged with a weight. By this arrangement the carrying power of a magnet is largely increased.

Fig. 2 shows a balance having a magnet at one arm, counter-balanced by a weight in a scale at the other arm. By such an arrangement the attractive power of another magnet, or of a piece of iron, may be observed and even measured, and also the law that the mutual attraction varies inversely as the square of the distance may be verified.

Fig. 3, below on the floor, represents two curved pieces of steel, pointed at one end and round at the other; when equally magnetized they will take the position represented, as the similar poles will repel one another. When the magnetism of one is inverted these ends will attract one another and they will follow the laws of attraction of dissimilar poles, and the ends will join on one side as well as on the other.

Fig. 4 shows how to magnetize a piece of steel, say, a knife, by means of a natural magnet by rubbing the whole length of the knife over one of the poles of a natural magnet, but only in one direction, returning beyond the magnetic influence as indicated by the dotted line.

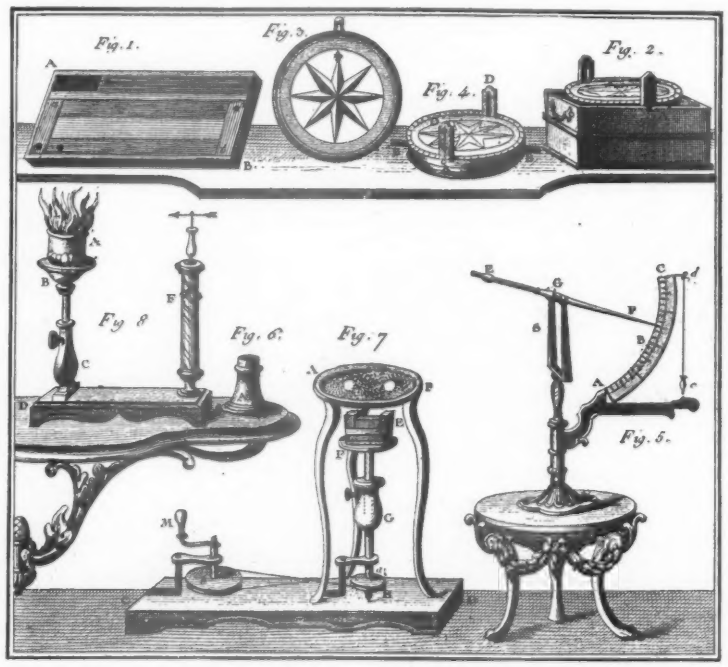


PLATE R.—ELECTRICITY 150 YEARS AGO.

Fig. 5 is a bundle of long steel plates kept together by brass straps. They are magnetized separately before being joined with the equal poles together; the result is a magnetism never fully equal to the sum of all, but far stronger than could be made by magnetizing a single solid piece of steel.

Fig. 6 is the same thing in the shape of a horseshoe.

Fig. 7 represents an imitation, in shape, of the natural magnet, Fig. 1, but made of steel plates joined and provided with the same style of armature as Fig. 1. They are also magnetized separately and then formed with equal poles.

Fig. 6 represents the shape of a magnetic steel bar, which 150 years ago was sold for the cure of toothache, but went out of use when people found out that it was useless, in the same way as at present magnetized corsets are sold, containing such magnetized electric steel bars, they are recommended for various ailments and no doubt will after a while be discarded when people find out their worthlessness.

Plate R, Fig. 1 represents what was called a magnetic magazine, consisting of a wooden box containing a number of thin magnetized steel bars, which are placed as bundles on each side of the box, on one side all the north poles to the right and at the other side reversely, with a piece of wood slightly shorter between them, these only are then furnished with armatures, when they preserve their magnetism longer. The advantage of such a combination is that each bar may be taken out separately and treated with the whole bundle of the rest, and so the whole of it may be made stronger and it proves magnetic in the end. The writer made such a

PLATE T.—PORTRAIT OF NICOLAS BION, OF PARIS.

magnetic magazine in 1826, and this without having any magnet at all, obtaining a first magnetic charge by rubbing each bar separately over the top of a Norway iron bar, some eight feet long, and placed in the direction of the dipping needle, which direction is represented in Fig. 8. When all the bars had thus been separately treated, they were joined and each in its turn taken out to be treated with all the others jointly with the most eminent success. This is one of the easiest experiments, gives the greatest satisfaction and success without fail, if the rubbing is done in the proper way as explained in all text-books.

Figs. 2, 3 and 4 represent the ship's compass. Fig. 2 as a whole. Fig. 3 is the rosette containing the needle, while Fig. 4 shows the mode of suspension so as to keep always horizontal on shipboard.

Fig. 7 represents a very interesting apparatus showing the lines of magnetic force on a flat disk under which a natural or artificial magnet can be rotated. It is placed with its poles upward; if iron filings are sifted on the top plate, they will at once arrange themselves according to the laws of magnetic attraction. When then the magnet is revolved by the contrivance shown in the figure a circulating wave motion will be observed among the iron filings above. The upper plate supporting the filings may consist of any material except a magnetic metal, such as iron or nickel.

Fig. 8 represents a contrivance intended to prove that the magnetic attraction is transmitted through flames; the vessel A being filled with some alcohol and this ignited, it is found that the magnet placed at the other side of the flame will act upon the needle as if the flame was not there; but when the needle is placed in the flame and heated its magnetism entirely disappears; it will be lost, and the needle will lose its temper and will have to be hardened over again and then remagnetized, otherwise it will be unable to receive permanent magnetism.

New York Electric Club.

In the absence of President Insull, Mr. C. R. Huntley, of Buffalo, N. Y., president of the National Electric Light Association, presided at the meeting of the Electric Club on Thursday evening, January 28. Mr. T. C. Martin read a prefatory address on the Hollerith electrical tabulating machine, after which Dr. Hollerith, the inventor of the device, explained and operated it. It required but 104 of Dr. Hollerith's machines to count and tabulate the statistics of the 62,000,000 population of this country recorded by the recent census. The old methods of counting the census were contrasted with the modern electrical device, to the great disadvantage of the former. This was the first time the Hollerith machine had ever been exhibited in public, and Dr. Hollerith was put to considerable trouble to bring his apparatus from Washington for the benefit of the Club.

At the conclusion of the exhibition a vote of thanks to Dr. Hollerith was passed. It is understood that this apparatus will be exhibited before the Society of Arts, at Boston, very shortly.

* This hypothesis of peculiar fluids appears to be so attractive to some minds that, only a few years ago, an investigator of electricity in New York, named Hall, finding how easy the phenomena of electricity, magnetism, heat and light, could be explained by such fluids, came forward among scientists with the hypothesis of the existence of a separate sonorous fluid, by which, according to him, all the phenomena of sound could be better explained than with the adopted acoustic theory of atmospheric vibrations. He died soon afterwards, and, of course, his theory with him.

GENERAL NOTES.

Forty-one electric light plants have been established in the South during the past three months.

The International Electrical Exhibition opened in St. Petersburg on the 4th inst. Many American inventions will be shown.

Recent experiments in France on the velocity of propogation of electric waves give a mean velocity which is almost exactly that of light.

An automatic electric gas extinguisher, depending on the variations in the electrical conductivity of selenium when exposed to the light, has been invented, so that on the appearance of daylight the gas is automatically turned out.

Two men employed in trucking the dead wire belonging to an electric power company, taken down in New York by order of the Board of Electrical Control, were recently caught in the act of stealing some 200 pounds of the same, disposing of it at a junk shop, No. 439 East Twelfth street.

The Electrical Fiber Carbon Company, of Detroit, Mich., held their annual meeting January 5, and the following officers were appointed for the ensuing year, George L. Maltz, president; Walton F. Stoddard, treasurer; George A. Morrison, secretary; R. B. Watson, vice-president and general manager, and John H. Davis, general superintendent.

Two young men entered the office of the Sawyer-Man Electric Company, in Boston, the other afternoon and stole $25 in cash from the safe. The office was occupied at the time only by two young women, the cashier and typewriter, the former of whom seized one of the men causing him to drop a part of his booty, but he drew a pistol and the men made their escape to a herdic in waiting at the door and drove off.

The following item appeared in the Chicago *Globe* recently regarding the business of the Western Electric Company: "There has been no great difference in the volume of business in our line for 1891 over 1890. Prices have been good and steady, and there has been a slight increase in the amount of our transactions. We cover a little more territory than previously, and the prospects for 1892 are very favorable." The Western Electric Company has recently purchased additional property for extending their works in Chicago. The lot is 193 feet by 318 feet.

seemed to be filled with them, and so bright appeared the night that it became easy to read newspaper print by the strange light. There was no flashing such as is made by lightning, but the light was of a mellow character and seemed to permeate the whole cloud and to take on part of the aurora light from the north, which all the while glowed with greater fervency than had ever been seen at this place. On the second night the same strange phenomena were witnessed, but in a much less degree, and since that time they have been absent, although the aurora has been very brilliant."

The Advantages of Long Distance Telephoning.

In an interview with Superintendent Mallett, of the Bell Telephone Company, by a representative of the *Post-Express*, of Rochester, N. Y., the advantages of the long distance service were very clearly and concisely put.

In response to a question on the subject, he said: "Business men are availing themselves of its advantages to carry on communication that could not be done by telegraph. They can discuss questions and negotiate as though they were face to face. The metallic circuit in use on the long distance line conveys the message perfectly. Where one has a city telephone with a metallic circuit he can get a message from New York or Boston in his own office. But with the ordinary ground circuit one living here could send a message to New York that would be understood, but he would not be likely to receive a distinct one in return. A new line has been opened to Pittsburgh, and it is now being extended to Chicago. There is a comparatively greater demand for long distance service in New York, Philadelphia and Boston than elsewhere. The greater population at those points does not account for it altogether; the value of the system appears to have received quicker recognition there. In the city of Rochester there is one firm that, pays $75 to $80 a month for its telephoning, and another paid over $125 last month."

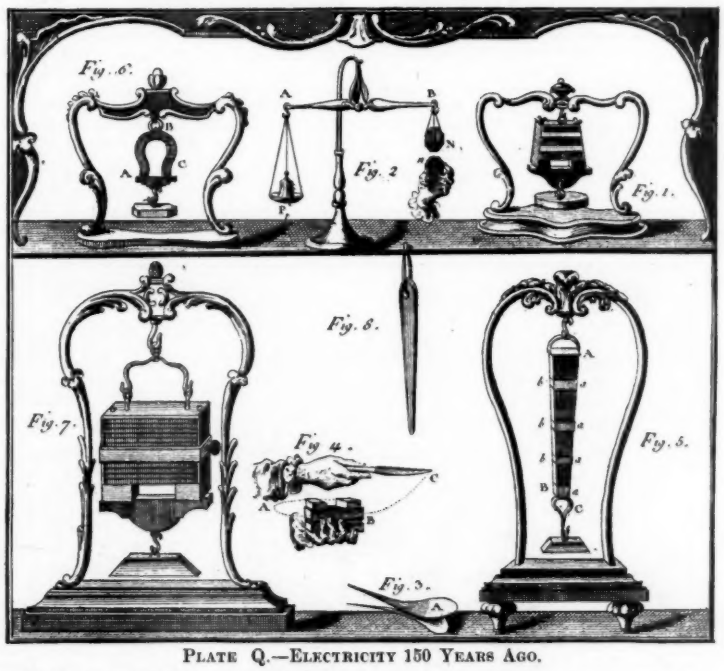


PLATE Q.—ELECTRICITY 150 YEARS AGO.

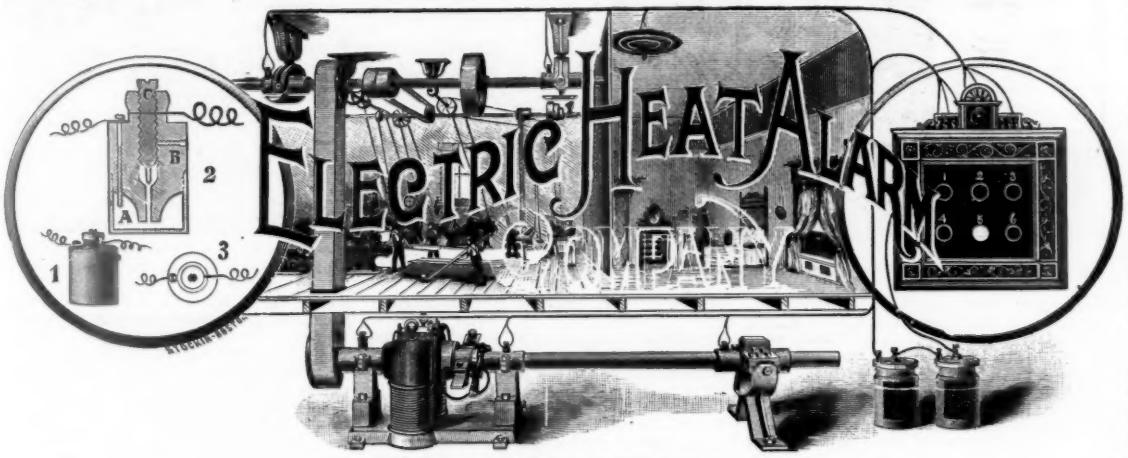
Automatic Electric Heat Alarm.

Among the many new electrical inventions recently introduced in the market is an ingenious and useful device, manufactured by the Electric Heat Alarm Company, No. 113 Devonshire street, Boston.

The device consists of a combination of a hollow metallic reservoir containing a quantity of mercury, a metallic plug having a small downwardly extending tubular bore, a conductor-wire or wire spindle supported and insulated within the plug and extending to such point, that it may be reached by the mercury when expanded and raised in the tube; the whole in combination with an electric battery, having one of its poles connected with plug mentioned, and the other pole connected by insulated conductor wire or spindle to a bell or other alarm or indicator.

The accompanying illustration, shows application of the heat alarm to shafting, bearings and a bed-room.

While similar in some respects to the well-known thermostat, the working of this electric heat alarm is absolutely reliable in immediate announcement of an overheated shafting or bearing, or when a bed-room temperature rises above a desired point.



THE AUTOMATIC ELECTRIC HEAT ALARM.

It possesses other meritorious features which commend the device to the public.

Electric Light Contracts Awarded.

The New York gas commission met last week and awarded contracts to the Brush Electric Light Company for 45 lamps, to the United States Illuminating Company for 66 lamps, and to the Harlem Lighting Company for 24 lamps, all at 40 cents a night. The companies' bids on these lamps were 45 cents a night, but they afterwards reduced the price to 40 cents, which was the price paid last year. The East River Company's bid for 16 lamps in Fifth avenue, bet Twenty-third and Forty-second streets, at 60 cents a night, was laid over, as the price was thought excessive.

Cookson, Neb., was recently witness, shortly after midnight, to a very brilliant and weird auroral display which is described as follows: "On the night in question the auroras were especially bright, and just after midnight what appeared to be electrical clouds made their appearance in the north and accumulated in vast numbers and floated to the south, disappearing at an angle of about 20 degrees, after passing low over the city. These clouds were of a most peculiar appearance, being bright and shimmering and the light increasing and decreasing, while all the while the clouds emitted a crackling noise similar to that emitted by tissue paper when it is rumpled or crushed. These clouds continued to increase in number until the whole heavens to the north of the city

TELEGRAPHIC

.... It is proposed to unite all the islands of Japan by a system of submarine telegraph cables. The estimated cost is $2,000,000.

.... The Western Union Telegraph Company, will probably string three duplex wires between Minneapolis and Chicago shortly.

.... The 25th inst. was the anniversary of the great rain and sleet storm of last year, which created such havoc among the electric wires of the country. It will long be remembered by telephone and telegraph men.

.... The Western Union Telegraph Company transmitted the recent message of President Harrison, containing over 5,000 words, to the *Mail and Express* in exactly 37 minutes; eight wires were used for the purpose.

.... A gentleman having excellent information regarding the condition and prospects of the Western Union Telegraph Company, says the *Boston News Bureau*, believes that dividend rates will be advanced to six per cent. some time during the present year.

.... Senator Mitchell has introduced a bill in Congress to provide for the construction of military and commercial telegraph lines along the Pacific Coast between Yaquina City and Port Orford, to connect New Port, Alsea Bay, Florence, Gardiner, Empire City and Marshfield, Oregon.

.... William W. Ryder, general manager of the Mutual District Telegraph Company, has sued W. J. Jackson, a box inspector in the employ of that company, for slander in the sum of $5,000. Jackson, it is alleged, called the general manager by some very uncomplimentary names in a loud tone and in the presence of others.

.... An ocean cable, to be worked by the Morse system, will begin work between New York and Nassau, New Providence, as soon as Patrick Burns, the Morse operator, can get to Nassau. He left New York last week. The new cable was landed at Nassau last Saturday. It lands in the United States on the Florida coast. The wire will run from New York to Nassau, *via* Jacksonville.

.... Mrs. Mary Birkett, has brought suit for $10,000 damages against the Western Union Telegraph Company. She asserts that she was dangerously ill and it had been previously arranged with her physician, in another town, that he was to hold himself in readiness to come to her at a moment's notice. She sent a telegram calling him, but owing to a delay of five hours in delivering the same, she suffered a series of hemorrhages which, she asserts, have permanently undermined her health.

.... Charles Frost, the telegraph operator who contracted with the Western Union Telegraph Company, and with Bookmaker Peter DeLacy, to furnish correct returns of the Gravesend races last year for $1,000 a day, has sued in a sum aggregating $100,000, for false imprisonment, against Michael and Philip Dwyer, Detective Robert Pinkerton and John Y. McKane. It will be remembered that Frost visited the race track daily in a carriage in company with several others and transmitted his reports to the outside by means of flashes of a small incandescent light placed in an aperture of his tall hat, using the Morse signals, the lamp being operated by the current from a battery in the bottom of the carriage, controlled by a small switch. Frost was discovered and arrested, his case went to the Grand Jury, but nothing was ever done.

The people of Bunker Hill, Ill., have appointed a council committee to investigate electric lighting for her streets. A proposition is already in hand.

* * The Kearney Electric Company have placed electric heaters in the electric cars at Omaha, Neb.

* * The council of Toronto, Can., will soon take up the question of what system of street car propulsion to adopt.

* * The Shaw Electric Crane Company, of Muskegon, Mich., is building an 80 ton crane for the government.

* * It is reported that the Camden, N. J., horse railroad will have its own power plant on the east bank of Cooper's creek.

* * The Thomson-Houston Electric Company has the contract for the electric equipment of the Rome, Ga., street cars.

* * Leominster, Mass., people are talking of equipping their street railway with electric power and extending it to Fitchburg.

* * The York, Pa., Street Railway Company have obtained permission to use electricity instead of horses for motive power.

* * The electric railway system of Rochester, N. Y., behaved very handsomely under the test of a heavy snow storm recently.

* * The Minneapolis Street Railway Company have ordered 60 gearless electric motors from the Short Electric Railway Company, of Cleveland, O.

* * Ottawa, Can., has had unqualified success with its electric street railway, notwithstanding the large amount of snow that has fallen this Winter.

* * A bill was recently introduced in Congress to authorize the postmaster general to construct a portelectric system for carrying the mails between New York and Brooklyn.

* * Nearly $1,100,000 of insurance is now carried on the World's Fair buildings and electric plant. The amount will be increased from time to time as the construction proceeds.

* * An effort is being made to promote an electric railroad between Newark and Passaic, N. J., to run on the Hudson County side of the river and join with the Passaic and Paterson road and the Newark Passenger Railway system.

* * The people of Berks and Lebanon Counties, Pa., are considering a project for building a line of electric railway along the abandoned Union Canal from Wornelsdorf to Bernville and thence by Strausstown, Rehrersburg, Millersburg, Wintersville and Stouchsburg to Sheridan on the Lebanon Valley Railroad.

* * A company was recently organized in Springfield, Ill., to build an electric railway from St. Louis to Chicago. Among those interested are Governor Francis, Congressman S. W. Cobb, John W. Harrison, J. G. W. Steadman, Webb M. Samuel, E. S. Ronee, William H. Thompson, Dr. Wellington Adams and John P. Kaiser.

The Safety Insulated Wire Company.

The Safety Insulated Wire Company, 234 West Twenty-ninth street, New York, have started in the new year with a rush. They have recently completed a large contract for wire used in the new Western Union headquarters in this city. They have also secured the contract for wiring the new United States cruiser "New York." Just after the recent storm in this city the Safety Insulated Wire Company did some remarkably quick work in supplying lead-covered cables to the local electric lighting companies, to take the place of overhead wires which had been blown down.

The Burton Electrical Forging System.

The use of electricity for forging and tempering metals is successfully applied by a process invented by Geo. D. Burton, of Boston, and will undoubtedly prove to be one of the greatest developments in the line of electricity applied to mechanics yet brought out.

The inventor of the forging machine which we are to consider, Mr. Geo. D. Burton, of Burton Stock Car fame, also owner of over 100 patents on various machines, realized this fully, and after two years of untiring zeal surmounted many obstacles, until to day he has a machine that will accomplish the desired results to perfection. The United States Patent Office has recently issued to Mr. Burton several broad patents, covering the features of his electrical forging process, and the company operating under his patents, and of which he is president, is now making active preparations to meet the large demands that have already accrued. The machines will be on the American market, it is expected, in a short time.

The practicability and efficiency of the process has been fully demonstrated through the numerous public tests that have been given from time to time by the inventor, and also by the severe and critical investigations of experts from all sections of this country and several from England, France and Germany, who have made special visits to the factory of the company for this purpose. The results have been highly flattering to the company, and several of their machines are now in use abroad; they having shipped the first perfected machines manufactured by them to England and Germany, sending men with them to set up the plants. Patents on the invention have already been issued to the inventor from the principal European nations.

About two years ago, while president of the Gould Rolling Machine Company, located at Leominster, Mass., Mr. Burton's attention was first called to the possibilities of improving on the methods therein employed. The company's process for making rolled forging was by oil heat, by which process articles produced were frequently hollow or "piped" in the center; and, although such high authority as Sir William Thomson had asserted that a current of electricity traversed the outer surface of a bar or rod of metal, Mr. Burton by experiments has demonstrated that a current of electricity would heat the interior first, and that the heat would radiate outwardly toward the surface, thus preserving the outward skin or shell of the metal. Broad patents have just been secured for the United States covering his process for heating the interior of the metal first, and preserving the skin or exterior surface, also for the generation, conversion and control of the current used in the carrying out of the electrical forging process. The process and its application are covered by some 40 patents, and brass, copper, steel and composition of metals are successfully worked thereby.

The Electrical Forging Company was organized February, 1890, with a capital of $2,000,000, divided into 20,000 shares of a par value of $100 each, fully paid and non-assessable. About $200,000 has already been spent in patents and experiments.

The value of the company's machines have been already realized, and it has orders on hand which it cannot fill for several months to come.

The basis of the business and plant is vested in the patents owned by the company, the same being the inventions of George D. Burton and E. E. Angell, which consist of apparatus and machines for the heating and forging of metals in all forms, the smelting of ores, cooking of food and heating of buildings, as well as other attainments by the use of electric heat.

These patents cover broadly the heating of metal for forging by electricity, that is, the heating of the metal by a current of electricity prior to shaping it by rolls, dies or other devices.

The company also own patents covering the mechanical application of the process to machines, thereby enabling the automatic electrical heating and working of metals into any desired form. These machines are of special construction, and can be adapted to the production of any desired form or bulk of metal.

The value of the company's processes and appliances is practically demonstrated from the fact that a heat equivalent to that obtained in the ordinary forge, and very much more uniform in degree, can be produced at much less cost than by former methods. Apparatus is constructed to yield, in the most economical manner, low pressure currents necessary for the production of electrical heat for all purposes, and is made in sizes ranging from 30 to 500 horse-power. The power can be derived from any source, as the current employed is low pressure.

The heat produced by the machines can be automatically regulated, which does away with the necessity of skilled labor. The machines are compact. Power is used only as required, and there is no waste of heat, as in old methods. But one large furnace is used, and consequently but little labor is necessary. The great saving in time and labor is a most important advantage of the invention. To illustrate, a piece of metal requiring 12 minutes to prepare in an ordinary forge, is heated and shaped by this company's process in less than 40 seconds. Then there is, also, the saving in the material used, as the process makes no scraps or waste in fins, which item amounts to considerable.

The great economy of the plant is one of the principal factors in its favor. The amount of fuel required to heat 100 pieces of metal in as many forges is, of course, out of all proportion to the fuel required to heat the same 100 pieces in a single forge, owing to the great waste of unavailable heat in each of the 100 forges. By the Electrical Forging Company's process the heat—or current—is applied only so long as needed, and all of the heat is expended on the piece of metal in process. In other words, the fuel, instead of being scattered in many forges, where a large part of it is unavailable as a direct heating agent, is concentrated at one point, *i. e.*, under the boiler furnishing power to the generator, and the saving thereby made in fuel is fully 30 per cent. for a given amount of work.

The operation of the machine is so simple that an ordinary workman accustomed to

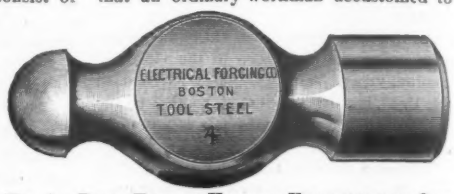


FIG. 1.—DROP FORGED HAMMER HEAD MADE AT ONE ELECTRIC HEAT BY THE ELECTRICAL FORGING COMPANY, BOSTON.

running hammers, rolls or dies, can handle them with perfect ease and certainty of result. The succeeding pieces of metal being automatically heated to exactly the same degree—when desired—the same skill is not required to duplicate the previous heating as when the metal is heated in the ordinary forge or furnace.

The importance of this invention is beyond computation, owing to the fact that in the manufacture of a vast number of articles it supercedes the work of the trip-hammers the lathe and other customary methods of forging. It wastes little or no material, while accomplishing many things heretofore deemed impossible, and is so quick and accurate in its operations that its productive capacity is far in advance of any other process in mechanics. It saves labor, material and time, and reduces the cost of production so that it must inevitably control the manufacture of any article that can be produced by it. With it the hardest metal is treated as easily as the softest metals were treated by the old process. A perfect thread is shaped on the hardest tool steel as quickly and easily as if made of the softest iron. For many years efforts have been made to produce round forgings by a rolling process, but all the experiments heretofore made have met with indifferent success.

By the Burton process one man with one machine produces 20,000 steel spheres per day of 10 hours. The metal bar being heated by electricity, an even heat is maintained and every sphere produced is made under the same degree of heat, which, in any other way at present is not obtainable.

The plant of the Electrical Forging Company, 163–169 Oliver street, is equipped with the most improved types of machinery. The electric power is obtained from the Edison Company's power station, which drives a 60 horse-power Thomson-Houston motor located in the factory, which has a peed of 1,020

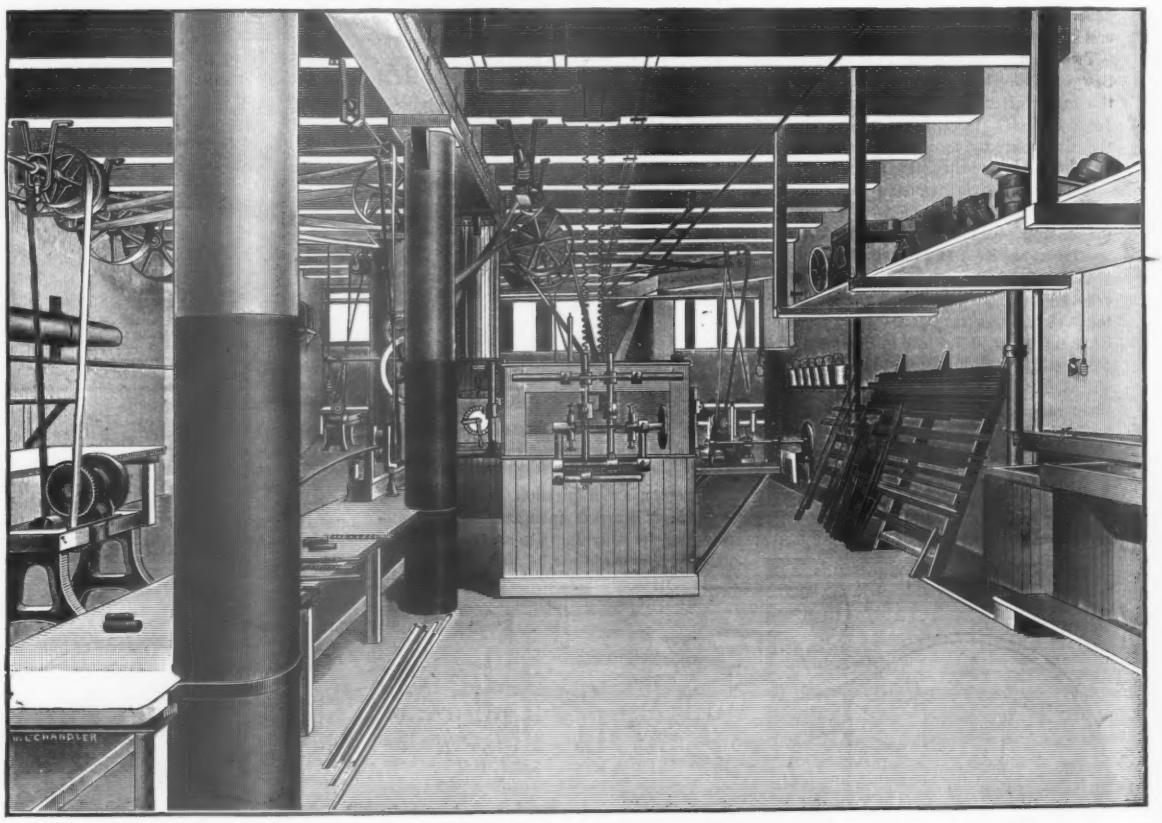


FIG. 2.—VIEW OF THE ELECTRICAL FORGING COMPANY'S SHOP, BOSTON, SHOWING TRANSFORMERS AND METAL HOLDING DEVICES.

revolutions per minute. The belt runs direct from the motor to the main shaft, and from this shaft a belt runs to the alternating current generator or heating apparatus, which is of a peculiar design, built especially for the Electrical Forging Company, the capacity being 60 horse power, and furnishing a current capable of heating a bar of steel or iron eight inches long and one inch square, its entire length, to a white heat in 20 seconds. The speed of the generator is about 650 revolutions per minute, with a pressure of 1,600 volts. The fields are excited by a two horse-power dynamo. Current is passed from the alternator through the company's converter, which reduces the current to a very low voltage and increases the intensity of the same to about 10,000 amperes. The conducting medium from the converter to the heating electrodes varies in size and capacity according to the piece desired to be heated. This also applies to the electrodes, which are of peculiar design and construction.

Binks and the Telephone.

There is a telephone in their residence, and as it is used principally by Mrs. Binks and her friends, it is perhaps natural that it should be identified solely with Mrs. Binks, and that Mr. Binks—well, Mr. Binks answered when the bell rang a few nights ago, and this is the conversation that took place:

"Hullo!"

"Well?"

"Is this Mrs. Binks?"

"No."

"I mean is this Mrs. Binks' telephone?"

"No; it's the company's."

"Well, is this Mrs. Binks' house?"

"I don't know, I'm beginning to think perhaps it is."

"What?"

"Yes. I guess it is. Everyone seems to think it is, anyway."

"Is Mrs. Binks' daughter there?"

"No."

"Well, who is this?"

"Oh, this is only Mrs. Binks' husband, the father of Mrs. Binks' daughter, the man who lives in Mrs. Binks' house and occasionally drives Mrs. Binks' horses. She got him with the house, you know."

"Oh, she did!"

"Yes, she did."

"Tough on Mrs. Binks, isn't it?"

That telephone will probably be taken out of the house.—*Toledo Bee.*

—— The Western Electrical Construction Company has transferred its plant, franchises, etc., to the Denver Consolidated Electric Company.

The New Wiremen's Union and the Edison Illuminating Company, of New York.

There is trouble between the wiremen of Electrical Union No. 5468, American Federation of Labor, and the Edison Electric Illuminating Company, of New York, in reference to the men employed by the latter. The walking delegate found that one of the ten wiremen employed at a building on Fifth avenue was a non-union man, who, being asked, refused to join the Union and reported the matter to his employers, and the nine Union men were discharged, so the delegate states. The Union resolved to order a strike on all the Illuminating Company's work.

Vice-President Bowker, in an interview, says: "This Company has not discharged any men. The strike, if ordered, will be caused solely by the unwillingness of some Union workmen and the walking delegate of the Union to permit a fellow-workingman who did not choose to join the Union to work in the same building with them. This company has stated explicitly to its men and representatives of the Union, that it did not propose either to ask any of its employés to join a Union or to refrain from joining one. It has taken the position that the right to earn his living is the most important right of a workingman, and is unwilling, either directly or indirectly, to interfere with the right of the workingman to say whether he will or will not join any labor organization.

"There has been no grievance whatever on the part of its men against this company, so far as I know or can learn, and the issue is made solely on the right of the workingman to work. There is no truth whatever in any statement or inference that this company at least has reduced its wages or is proposing to do so; on the contrary, before this Union question had come up, the company was developing a system of profit-sharing which would be in addition to the wages paid, and has already been considering a method of work and promotion which would give the best men in its employ considerably higher wages than the by-laws of the Union propose to put in operation on April 1.

"Furthermore," Mr. Bowker added, "the statement which was published in the morning papers of to-day that students and graduates of technical schools were employed at a lower rate of wages than the regular wiremen and other workers of the company, is wholly unfounded. The company never has and never will employ and pay men on any other ground than that of their individual merit."

New Sound Steamers.

The steamer "New Hampshire," the second of two twin steamers being built for the Stonington line, at Wilmington, Del., was launched at Harlan & Hollingsworth's yard on January 16. The steamer "Maine," the sister ship of the "New Hampshire," was launched on October 31 last, and is now well along towards completion.

As the first propellers to be put into service on Long Island Sound, these vessels are exciting much interest among shipping men, as it is expected that, if successful, they will bring about a revolution in Sound travel from the old-fashioned side-wheeler to the more modern propeller.

These two vessels are to be exactly alike in every detail; their general dimensions are: Length on water line, 302 feet 7 inches; length over all, 310 feet; beam molded on load water line, 44 feet; width over guards, 60 feet; draft 12½ feet. There is an annunciator service from every stateroom and a special service between the officers' quarters. The steamers will be lighted by electricity, about 600 lights being installed on each vessel, side and stern lights being also electric, and a search-light will be mounted upon the pilot house. The main engine of these steamers will be an inverted, direct acting, surface condensing, triple expansion engine with four cylinders, 28, 45, 51 and 51 inches in diameter, with 42 inch stroke. The propeller is of cast iron, left-handed, four bladed, and 13½ feet in diameter. Four Scotch type boilers will be installed in each vessel. These will be 13 feet 6 inches in diameter and 11 feet 6 inches long, and will be made of steel having a tensile strength of 60,000 pounds to the square inch. Each boiler has three corrugated furnaces 46 inches outside diameter, comprising 274 square feet of grate surface. The boilers will be worked at a pressure of 160 pounds to the square inch.

—— Westinghouse Electric Company, according to the *Boston News Bureau*, has declared an interim dividend of one per cent. on preferred stock, for the fractional part of the quarter, ending December 31, payable February 1.

—— An order was passed by the city of Haverhill, Mass., recently authorizing the Mayor to petition the Legislature for the passage of an act giving the city authority to purchase or establish one or more electric light or gas plants in the city.

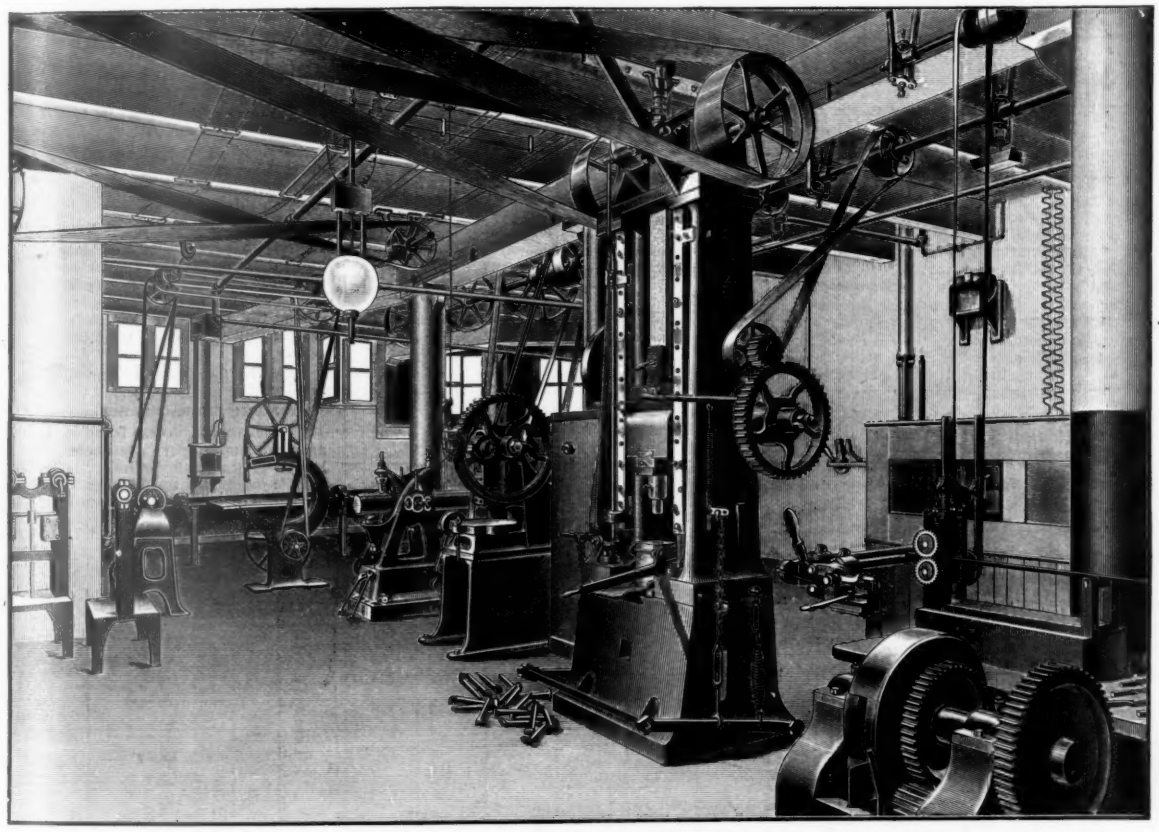


FIG. 3.—VIEW OF NEW SHOP OF THE ELECTRICAL FORGING COMPANY, BOSTON, SHOWING HEAVY ELECTRICAL FORGING MACHINES.

ELECTRIC LIGHT NEWS

—— Rochester, Minn., talks of a municipal lighting plant.

—— Marcus Hook, Pa., is going to have electric street lighting.

—— Dickenson, North Dakota, wants to be lighted by electricity.

—— Ellendale, North Dakota, is talking of putting in electric lights.

—— Wapakoneta, O., is agitating the use of electricity for its street lights.

—— It is rumored that Manasquan, N. J., is to have an electric light plant.

—— Hon. Isaiah Dow is talking of putting in a plant to light Burlington, Vt.

—— Unionville, N. Y., wants electric lights. Address E. L. Brown & Son.

—— The citizens of Mansfield, Ill., are looking up the electric street lighting subject.

—— The residents of Atlantic Highlands, N. J., are organizing an electric light company.

—— It is proposed to install a plant to light the State House at Augusta, Me.; a committee is looking up the question of cost.

—— Daniel Babst, of Crestline, O., who holds the franchise for all electric street railways for Galion, O., is negotiating for the plant.

—— The Thomson-Houston Electric Company have declared a dividend of $1 per share on the common stock, payable February 15.

—— The Thomson-Houston Carbon Company will rebuild at Fremont, O. The town is to pay a bonus of $35,000 to retain the works there.

—— Plans are being drawn for a large foundry building to be erected by the Thomson-Houston Company at Lynn, near the Saugus river.

—— The Edison General Electric Company are now building a 200-kilowatt machine. It will furnish enough current to operate 6,400 sixteen candle-power incandescent lights.

—— The Edison General Electric Company has just closed a contract with the Nemasket Cotton Company, at Taunton, Mass., for a plant of 750 incandescent and 58 arc lights.

—— An arrangement has been made whereby the Thomson-Houston and United States Electric Light Companies will be consolidated on February 1. They will take the name of the Buffalo Electrical Company.

—— It is reported that the Thomson-Houston Electric Company has purchased 60 acres of land at Lynn, Mass., bordering on the Saugus river. The company is to erect coke sheds and obtain their fuel direct. The river channel is to be enlarged and made accessible for vessels.

—— Two petitions for foreclosure were filed in the county clerk's office at Dubuque, recently, against the Dubuque Light and Power Company. The Davenport Foundry and Machine Company is the petitioner, holding two mechanics' liens, one for $300 and the other for $5,000, against the Dubuque company.

—— The Brush Electric Company, of Cleveland, on the 19th ult., filed three additional suits in the United States Circuit Court, against Mandee Bros., Geo. H. Williams & Company and Frank Bros., of Chicago, alleging that these firms are using arc lamps that are infringements of patents owned by the complainants. The lamps are of the double carbon variety and were made by several electric light companies.

On the Law of Hysteresis.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, JANUARY 19, 1892, BY CHARLES PROTEUS STEINMETZ.

(*Continued from page* 313.)

II. — MAGNETIC CIRCUIT BUILT UP OF WELL INSULATED LAYERS OF VERY THIN SHEET-IRON. FIG. 3; TABLES III.

MAGNETIC CHARACTERISTIC.

F = Magneto-motive force in ampere turns per centimetre length of magnetic circuit.

B = magnetization in lines of magnetic force per square centimetre.

TABLE III. (1)

F	B	F	B	F	B
2	1700	12	13,750	45	17,500
3	4200	14	14,260	50	17,900
4	7400	16	14,600	55	18,300
5	9200	18	14,900	60	18,650
6	10,400	20	15,200	65	19,030
7	11,160	25	15,700	70	19,380
8	11,850	30	16,200	75	19,730
9	12,470	35	16,680	80	20,080
10	13,070	40	17,050	85	20,400
				90	20,750

HYSTERESIS.

B = magnetization in lines of magnetic force per square centimetre.

H = loss of energy by hysteresis, in ergs per cycle and cubic centimetre, $= 10^{-7}$ watt seconds.

CLOSED MAGNETIC CIRCUIT.

Frequency: $N = 85$ complete periods per second.

TABLE III. (2)

B	H obs.	H calc.	$H-H=$ calc. obs.	Per Ct.
5910	3320	3140	−180	− 5.7
6200	3690	3420	−270	− 7.9
7690	4420	4700	+480	+10.2
10,470	7160	7700	+540	+ 7.0
11,110	8370	8464	+ 96	+ 1.1
14 030	12,600	12,280	−320	− 2.6
14.890	13,730	13,540	−190	− 1.4
17,190	17,040	17,040		
17,940	17,570	18,240	+670	+ 3.7
		av:	±345 =	± 4.4

Exponent of power derived from tests: $x = 1.6041 \sim 1.6$.

Co-efficient of hysteresis: $\eta = .00285$; hence, theoretical curve $H = .00285\ B^{1.6}$.

TABLE III. (3)

Frequency: $N = 138$ complete periods per second.

B	H obs.	H calc.	$H=\ H=$ calc. obs.	Per Ct.
5220	3030	3015	− 15	− .5
5750	3620	3550	− 70	−1.9
6540	4320	4355	+ 35	+ .8
7070	4830	4890	+ 60	+1.2
8210	5950	6160	+ 210	+3.4
8520	6090	6530	+ 440	+6.7
9570	7850	7840	− 10	− .1
10,459	8780	9040	+ 260	+2.9
11,990	11,060	11,230	+ 170	+1.5
14.570	15,840	15,340	− 500	−3.3
14.660	16,160	15,580	− 580	−3.7
16.770	20,350	19,260	−1090	−5.6
17.970	20,620	21,440	+ 820	+3.9
19,320	23,180	24,120	+ 940	+3.8
		av:	± 371=	±2.8

Exponent of power derived from tests: $x = 1.6044 = 1.6$.

Co efficient of hysteresis: $\eta = .00335$; hence, theoretical curve $H = .00335\ B^{1.6}$.

TABLE III. (4)

Frequency: $N = 205$ complete periods per second:

B	H obs.	H calc.	$H-H=$ calc. obs.	Per Ct.
6360	4440	4660	+220	+ 4.8
7340	5380	5780	+400	+ 6.9
10 030	9510	9510		
10.860	9980	10,670	+690	+ 6.5
12.230	13,700	12,940	−760	− 5.9
14,600	17,390	17,160	−230	− 1.3
14,700	17,830	17,340	−490	− 2.8
15,750	19,700	19,360	−340	− 1.7
16,700	21,990	21,300	−690	− 3.2
		av:	±425	± 3.7

Exponent of power derived from tests: $x = 1.697 = 1.6$.

Co-efficient of hysteresis: $\eta = .00373$, hence, theoretical curve: $H = .00373\ B^{1.6}$.

OPEN MAGNETIC CIRCUIT.

Two gaps of $\sim$ 4 cm. length.

TABLE III. (5)

Frequency: $N = 138$ complete periods per second.

B	H obs.	H calc.	$H-H=$ calc. obs.	Per Ct.
3150	1570	1560	− 10	− .6
3640	2110	2020	− 90	− 4.4
4690	2980	2950	+ 20	+ .7
5490	3510	3780	+ 270	+ 7.2
6270	4380	4600	+ 310	+ 6.6
10,250	10,450	10,290	− 160	− 1.6
11,000	11,810	11,520	− 290	− 2.5
12,280	14,250	13,740	− 510	− 3.7
		av:	± 208	± 3.4

Exponent of power derived from tests: $x = 1.6040 \sim 1.6$.

Co efficient of hysteresis: $\eta = .00394$, hence, theoretical curve: $H = .00394\ B^{1.6}$.

From these four sets of readings we get the results:

CLOSED MAGNETIC CIRCUIT.

$N =$	85	9 readings:	$x = 1.6041$	$\eta = .00285$
	138	14 "	1.6044	.00335
	205	9 "	1.6970	.00373

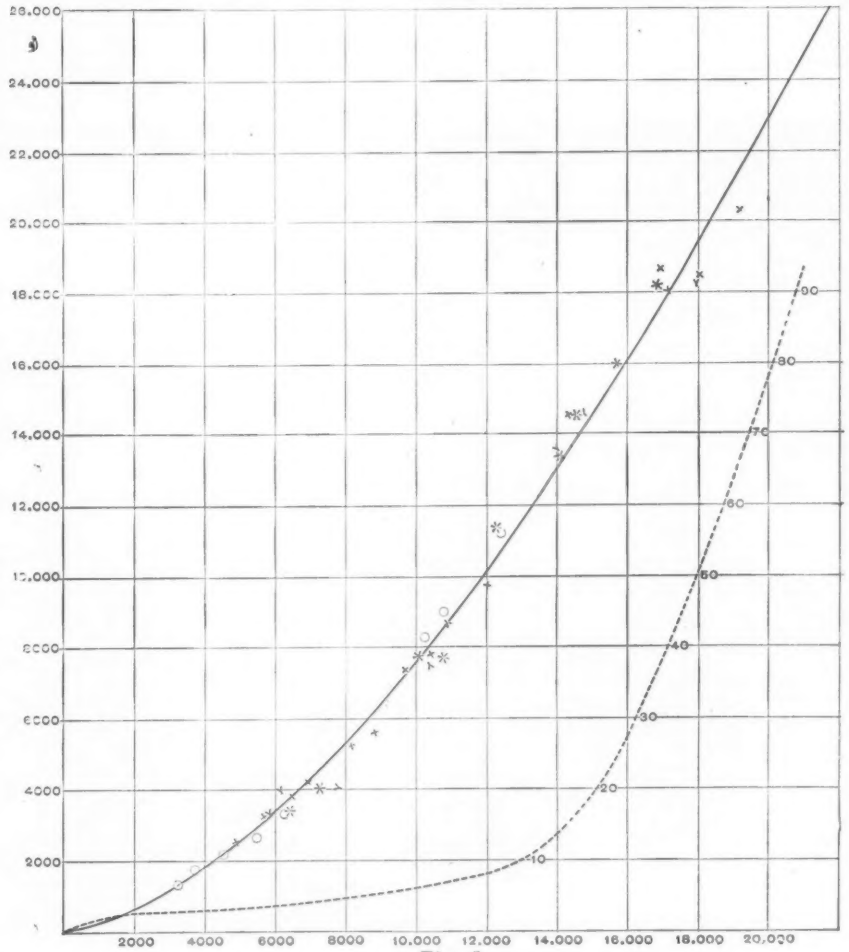


Fig. 3.

OPEN MAGNETIC CIRCUIT.

$N = 138$ 8 readings: $x = 1.6040$ $\eta = .00393$

Herefrom it seems that the consumption of energy by hysteresis per magnetic cycle increases with increasing frequency—that is, with increasing velocity of the magnetic change.

The three values of three co-efficients of hysteresis for closed circuit in their dependence upon the frequency N, can be expressed by the *empirical* formula:

$$\eta = (.0017 + .000016\ N - .00000003\ N^2)$$

To compare the values of hysteretic loss for different frequencies in Fig. 3, the curve of hysteretic loss for $N = 100$ complete periods per second is plotted, giving:

$$\eta_{100} = .003$$

hence,

$$H = .003\ B^{1.6}$$

and the observed values of H are not directly drawn in, but the observed values of H multiplied with the factor:

$$\frac{\eta_{100}}{\eta_{\text{obs}}}$$

to compare the different frequencies with each other.

These values are plotted for:

$N =$ 85 with the mark Y
138 " " +
205 " " * } Closed magnetic circuit.

$N = 138$ with the mark o; Open magnetic circuit.

From this curve of hysteretic loss,

$$H = .003\ B^{1.6}$$

we derive the values for the frequency of $N = 100$ complete periods per second.

TABLE III. (6)

B	H	B	H
1000	190	13,000	11,460
2000	570	14,000	12,900
3000	1100	15,000	14,430
4000	1740	16,000	15,990
5000	2490	17,000	17,610
6000	3330	18,000	19,290
7000	4260	19,000	21,060
8000	5280	20,000	22,830
9000	6360	25,000	32,640
10,000	7530	30,000	43,680
11,000	8790	35,000	55,950
12,000	10,080	40,000	69,270

Especially noteworthy is the last set of readings, on open magnetic circuit, in so far as it proves the fallacy of the general opinion that the hysteretic loss of energy in the iron is smaller in the open magnetic circuit than in the closed circuit.

For the co-efficient of hysteresis observed on open magnetic circuit, $\eta = .00393$, is even greater than that for closed magnetic circuit, $\eta = .00335$.

But this discrepancy is easily explained by the fact that in the closed magnetic circuit the magnetization is nearly uniform throughout the whole iron. But in the open magnetic circuit the magnetic field intensity differs considerably from point to point, being a maximum in the middle of the magnetizing coils, a minimum at the ends of the iron sheets. Now, the values of B, given in the table, are the average values of the magnetization, and the values H, the average values of hysteretic loss. But the average value of the 1.6th powers of different quantities B is larger than the 1.6th power of the average value of B.

For instance, in a cubic cm. of iron magnetized to $B = 12{,}000$ is $H = 10{,}080$; in a cubic cm. of iron magnetized to $B = 6000$ is $H = 3330$; hence of these 2 cubic centimetres the average magnetization is $B = 9000$, and the average $H = 6.705$ ergs but to $B = 9000$ corresponds $H = 6360$ ergs; that is, about 5 per cent. less, and the difference becomes still greater, if the values B differ still more.

Taking this into account, it seems that the loss of energy due to hysteresis depends only upon the intensity of magnetization, and perhaps upon the frequency, but is independent of open or closed magnetic circuit, as is to be expected.

III.—FIG. 4. TABLES IV.

A third set of determinations of the hysteretic loss of energy is given in the following:

Again a magnetic circuit was built up of 17 layers of a soft kind of sheet-iron, each layer consisting of two pieces of 20 cm. length, 2.54 cm. width, and two pieces of 7.6 cm. length and 2.54 cm. width, of the thickness $\delta = .0686$ cm.

Here evident proof of the induction of eddy currents in the iron was found. Especially perceptible was a decrease in the watts consumed by the iron, when a larger magneto-motive force of high frequency was left acting upon the iron. This decrease must be attributed to the increase of the electric resistance of the iron, caused by its increasing temperature.

To eliminate this source of error as far as possible, before each set of tests an alternating current of high frequency ($N = 200$) and considerable strength was sent through the magnetizing coils and left on for 10 to 15 minutes, and then first readings with low magnetization, then with high, and then again with low magnetization were taken. But, nevertheless, as was to be expected, in these tests the observed values agreed less with each other than in the former readings.

The method of determination, the apparatus, etc., were the same as in the second set of tests, only that ammeter, voltmeter and wattmeter were used at the same time. In calculating these tests, the law of the 1.6th power was assumed as true, and the loss of energy in the iron expressed by the equation

$$H = \eta\ B^{1.6} + \varepsilon\ N\ B^2$$

where

$$H_1 = \eta\ B^{1.6}$$

is the true hysteretic loss per cycle and cm.^{3}, which is independent of the frequency, and

$$H_2 = \varepsilon\ N\ B^2$$

is the loss of energy by eddy current per cycle, which is proportional to the frequency N.

From this expression

$$H = H_1 + H_2$$

the co-efficients η and ε were calculated, and the agreement or disagreement of these coefficients η and ε allow now to check the correctness or incorrectness of the law of the 1.6th power.

These tests gave the following results:

MAGNETIC CHARACTERISTICS.

F = magneto-motive force in ampere turns per centimetre length of magnetic circuit.

B = magnetization in lines of magnetic force per square centimetre.

TABLE IV. (1)

F	B	F	B	F	B
1.5	2,700	7	11,700	18	15,450
2	4,350	8	12,200	20	15,800
3	7,100	9	12,700	25	16,400
4	8,850	10	13,100	30	16,800
5	10,000	12	13,900	35	17,200
6	10,800	14	14,500	40	17,500
		16	15,000		

HYSTERESIS.

B = magnetization in lines of magnetic force per square centimetre.

H = loss of energy by hysteresis, in ergs per cycle η ch-cm. $(= 10^{-7}$ joules$) = H_1 + H_2$.

$H_1 = \eta\ B^{1.6}$ = loss of energy by hysteresis proper, in ergs per cycle and cm.^{3} $(= 10^{-7}$ joules).

$H_2\ \varepsilon\ N\ B^2$ = loss of energy by eddy currents, in ergs per cycle and cm.^{3} $(= 10^{-7}$ joules).

TABLE IV. (2)

Frequency: $N = 78$.

$\eta = .00331$ $\varepsilon = .751 \times 10^{-6}$.

B	H_1	H_2	H(*) calc.	H obs.	Δ	$= \%$
4171	2,060	1,080	3,140	3,060	+ 80	+ 2.6
5850	3,540	2,120	5,660	5,640	+ 20	+ .3
9520	7,740	5,600	13,340	13,440	− 100	− .8
13,160	12,960	10,710	23,670	24,540	− 870	− 3.7
14,320	14,880	12,720	27,600	26,460	+1140	+ 4.0
16,050	17,280	15,900	33,180	33,180		
				av:	{+6.9} {−4.5}	±1.9(+.4)

* H is calculated by using for η the mean value $\eta = .00333$, but for ε the individual values, corresponding to the particular set of observations.

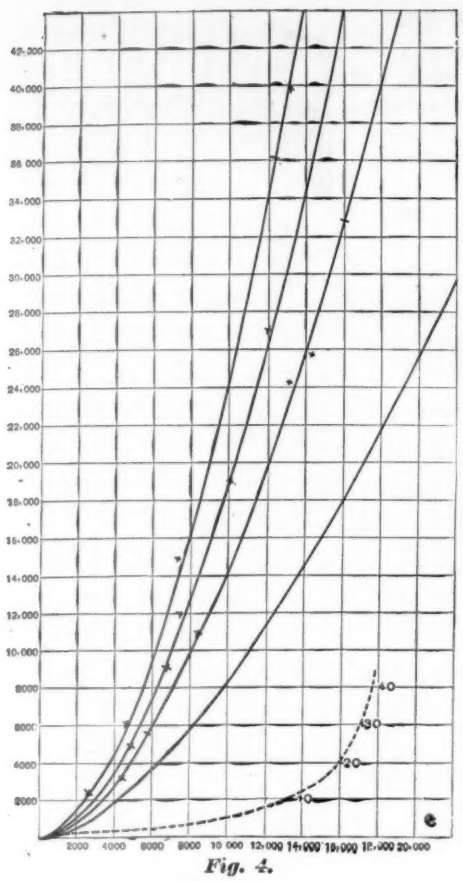


Fig. 4.

lation was the same as in III., and the same precautions were taken.

The dimensions of the horseshoe magnets were:

Mean length of magnetic circuit, 38 cm.
" cross-section, 70 cm.²
" volume of iron, 2660 cm.³
" distance of keeper from magnet, in the first case, .15 cm.
" distance of keeper from magnet, in the second case, .08 cm.

each magnet consisting of 300 sheets well-insulated iron of the thickness .0405 cm.

In the first set of readings considerable eddy currents were found; in the second set only a small amount of eddies.

The magnetic susceptibility of the iron was not determined, because the reluctance of the magnetic circuit mainly consisted of that of the air gap between magnet and keeper.

The results were:

B = magnetization in lines per cm.²

H_{obs} = observed loss of energy in the iron, in ergs per cycle and cm.³ for $N = 170$.

H_1 = true hysteretic loss of energy.

H_2 = loss of energy by eddy-currents.

H_{calc} = whole calculated loss of energy $= H_1 + H_2$.

TABLE IV. (3)

Frequency: $N = 140$.

$\eta = .00331$ $\varepsilon = .730 \times 10^{-6}$

B	H_1	H_2	H (*) calc.	H obs.	△	= %
4880	2,650	2,720	5,360	5,280	+ 80	+ 1.5
6780	4,490	5,270	9,760	9,420	+ 340	+ 3.4
7720	5,530	6,830	12,360	12,000	+ 240	+ 1.9
10,200	8,640	11,940	20,580	20,400	+ 180	+ .9
12,080	11,300	16,700	28,000	29,100	−1100	− 4.0
17,200	19,860	33,840	53,700	53,000	+ 700	+ 1.3
				av:	{+7.1 / −5.9}	±2.2(+.2)

TABLE IV. (4)

Frequency: $N = 207$

$\eta = .00336$ $\varepsilon = .757 \times 10^{-6}$

B	H_1	H_2	H (*) calc.	H obs.	△	= %
2710	1,030	1,290	2,320	2,340	− 20	− .8
4720	2,510	3,910	6,430	6,480	− 50	− .8
7540	5,320	9,970	15,290	15,930	−670	− 4.4
12,380	11,700	26,800	38,500	38,500		
13,200	13,000	30,400	43,400	42,600	+800	+ 1.8
				av:	{+1.8 / −6.0}	±1.6(−.8)

Therefrom we get the results:

N= 78, 6 readings, η=.00331 ε=.751×10⁻⁶
140, 6 " .00331 .730×10⁻⁶
207, 5 " .00336 .757×10⁻⁶

The values found for η are so nearly alike that we can consider them as constant, and take their mean value

$$\eta = .00333$$

as the co-efficient of hysteresis.

Even the values found for ε are not much different from each other, not more than was to be expected from the unavoidable differences in the temperature of the iron, which, because of the high electric temperature co-efficient of iron, makes ε rather variable.

Taking the average of ε, we derive

$$\varepsilon = .746 \times 10^{-6}$$

and as formula of iron loss,

$$H = .00333\ B^{1.6} + .746 \times 10^{-6}\ N B^2$$

In Fig. 4 are drawn the four curves,

1. True hysteretic loss. $H = .00333\ B^{1.6}$
2. Iron loss for $N = 78$ $.00334\ B^{1.6} + .00005856\ B^2$
3. " " 140 $.0001022\ B^2$
4. " " 209 $.0001567\ B^2$

The observed values are plotted by crosses, +

IV.—FIGS. 5 AND 6. TABLES V AND VI.

Two other sets of determinations of the hysteretic loss of energy for the frequency 170 complete periods per second, were made on two laminated horseshoe magnets with laminated keeper or armature.

The method of observation and of calcu-

* H is calculated by using for η the mean value calc. $\eta = .00333$, but for ε, the individual values corresponding to the particular set of observations.

TABLE V.

Frequency: $N = 170$.

$\eta = .0045$ $\varepsilon = 1.16 \times 10^{-6}$

B	H_1	H_2	H calc.	H obs.	$H-H$ calc. obs.	= %
342	51	23	74	70	+ 4	+ 5.3
410	68	34	102	102		
546	108	59	166	166	+ 1	+ .6
626	132	78	210	219	− 9	− 4.3
670	150	90	240	234	+ 6	+ 2.5
746	178	111	289	300	− 11	− 3.7
830	210	138	348	333	+ 15	+ 4.3
1020	293	208	501	524	− 23	− 4.5
1100	345	234	579	549	+ 30	+ 5.3
1200	392	290	682	695	− 13	− 2.0
1310	436	343	779	795	− 16	− 2.1
1490	539	445	984	985	− 1	− .1
1930	820	742	1562	1547	+ 15	+ 1.0
2600	1310	1280	2590	2670	− 80	− 3.1
				av:	{+ 71 / − 153}	+19 0 −19.8
					± 16	± 2.8

Therefore we get the formula for the loss in the iron,

$$H = .0045\ B^{1.6} + 1.16\ N \times 10^{-6}\ B^2.$$

In Fig. 5 are shown,

1. The curve of true hysteretic loss, $H_1 = .0045\ B^{1.6}$
2. The curve of the whole loss in the iron, $H = H_1 + H_2$

with the observed values marked by crosses +

TABLE VI.

Frequency: $N = 170$.

$\eta = .00421$ $\varepsilon = .2083 \times 10^{-6}$

B	H_1	H_2	H calc.	H obs.	$H-H$ calc. obs.	= %
85	5.2	.3	5.5	5.6	− .1	− 1.8
182	17.3	1.3	18.6	16.9	+ 1.7	+10.0
211	22.0	1.7	23.7	23.5	+ .2	+ .9
560	105	11	116	122	− 6	− 5.0
670	140	15	155	146	+ 9	+ 6.1
685	145	16	161	157	+ 4	+ 2.6
775	176	21	197	202	− 5	− 2.4
800	186	22	208	200	+ 8	+ 4.0
1000	265	35	300	300		
1070	296	41	337	353	−16	− 4.6
1130	322	47	369	386	−17	− 4.3
1250	379	56	435	430	+ 5	+ 1.2
1380	445	69	514	514	−26	− 4.7
2200	940	170	1110	1130	−20	− 1.8
2420	1090	208	1298	1268	+30	+ 2.4
					+38	+27.2
					−90	−24.6
					±10	± 3.4

Therefore we get the formula for the loss in the iron,

$$H = .00421\ B^{1.6} + .2083 \times 10^{-6}\ N B^2.$$

In Fig. 6 are shown,

1. The curve of true hysteretic loss, $H_1 = .00421\ B^{1.6}$
2. The curve of the whole loss in the iron, $H = H_1 + H_2$

with the observed values marked by crosses +

Especially interesting are these two sets of readings, in so far as they cover quite a different range of magnetization, as the tests in I. to III.

In I. to III. the tests cover the range from 1,790 to 19,340 lines of magnetic force per cm.², that is, for medium magnetization up to high saturation, while the tests in IV. cover the range from 85 to 2,600 lines per cm.², that is, from medium down to very low magnetization.

The law is found exactly the same,

$$H = \eta\ B^{1.6} + \varepsilon\ N\ B^2$$

and herewith proved for the full range from 85 lines per cm.² up to 19,340 lines, a ratio from 1 ÷ 230.

This seems not to agree with Ewing's theory of the molecular magnets. According to this theory, for very small magnetiza-

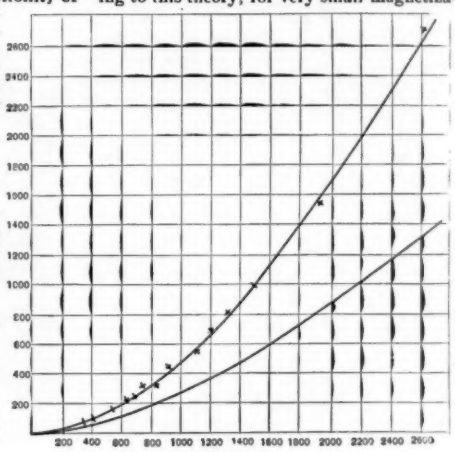


Fig. 5.

tion the hysteresis should be expected to disappear, or almost disappear, and the cycle be reversible. Then for medium magnetization, where the chains of molecular magnets break up and rearrange, hysteresis should increase very rapidly, and slowly again for saturation. Nothing of this is the case, but hysteresis seems to follow the same law over the whole range of magnetization, and is certainly not zero for even such a low magnetization as 85 lines per cm.²

(To be Continued.)

WITH THE TRADE.

The American Electrical Works, of Providence, R. I., have issued to their patrons one of their usually tasteful calendars for '92.

The New York Insulated Wire Company have about got settled in their

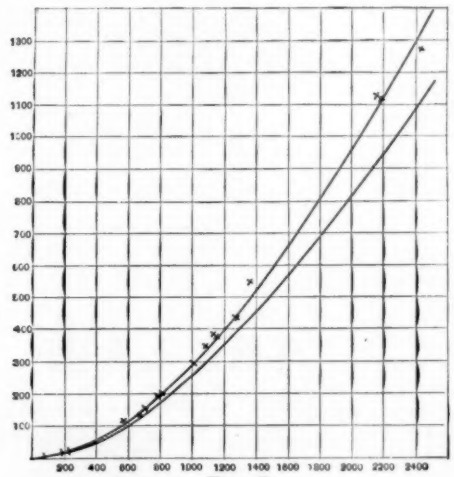


Fig. 6.

elegant new offices at 15 Cortlandt street. The furnishings are artistic and comfortable.

The Wrought Iron Casting Company, South Boston, Mass., have recently installed a 100 horse-power automatic cut-off engine, built by the Ball Engine Company, Erie, Pa.

The Viaduct Manufacturing Company, of Baltimore, Md., corner of Charles and German streets, have just issued a new catalogue and price list of their specialties. It is very complete and handsomely gotten up.

The Law Telephone Company, of 85 John street, New York, manufacturers of the celebrated Law battery, mailed us a very effective and odd advertising novelty in a form imitating a newspaper wrapped for mailing.

J. L. Somoff, 1 Ann street, New York, has issued Part I of his illustrated catalogue of miniature incandescent lamps. Any one who is interested in decorative electric lighting effects will do well to have one of these catalogues by him.

The Electric Engineering and Supply Company, of Syracuse, N. Y., have appointed Mr. F. C. Timpson their agent in this city, with headquarters at 18 Cortlandt street. Mr. Timpson has many friends in the electrical trade, and his well known push and ability will tell in the excellent connection which he has made. We wish him every success.

J. H. Bunnell & Company, 76 Cortlandt street, New York, have issued their general catalogue No. 12 for 1892. It is a handsome pamphlet and conveniently arranged for reference. The company say it is not as complete as they would like to have it, and that a supplementary catalogue will soon be issued containing much that had to be omitted in No. 12 because of lack of space.

Messrs. Fraser & Chalmers of Chicago, Ill., the great manufacturers of mining machinery and steam engines, have now shown their readiness to recognize the merits of electricity as a power transmitter and are about to fit up the foundry and boiler shop and the pattern shop in their Twelfth street works with an electric power plant. This plant will consist to two 80 kilowatt generators, one 25 horse-power motor, eight 10 horse-power and eight 5 horse-power motors, distributed throughout the various buildings. The generators and motors will be wound for a pressure of 250 volts. One advantage which is expected to be derived from the use of this potential is that while the electromotive force on the motor circuits will be kept down below any possible danger mark, yet by connecting two dynamos in series a pressure of 500 volts will be obtained, which will permit of testing the various electrical mining machines, the motors for which are usually wound for this higher potential. Messrs. Fraser & Chalmers have had this plant under consideration for some months, and the competition among the various motor companies has been keen. To the "C. & C." Electric Motor Company was awarded the prize in the shape of the contract for this installation. It is understood that part of this plant is to be in running order within 60 days and the entire installation is to be completed within 90 days. The plant will be one of the largest as yet installed for general power purposes, and will afford an excellent demonstration of the advantages of electricity under conditions such as exist in Messrs. Fraser & Chalmers' works.

The Live Wire.

The one overruling fear that people seem to have is that of the live wire, and even if a poor little innocent coil of wire lies upon the sidewalk some pedestrians will cross the street to keep out of the way of the electricity which, it is supposed, lurks in it. A few days ago linemen were arranging wires upon the poles in front of the Hudson River Telephone Company's new building on the corner of Chapel street and Maiden lane, and as was necessary, the wires lay in a harmless mass on the sidewalk. The tourist stood and watched the people as they moved past the building. One man came up the street. He was apparently a lawyer, on his way to the city hall, and seemed to be wrestling with some tremendous legal question, when he nearly walked upon the coil. The jump he gave from the sidewalk to the gutter when the idea of his seeming danger suddenly dawned upon him would have made even the austere judge before whom he was to appear adjourn court so that he might laugh. The next put to flight was a pretty girl with books under her arm, on her way to the high school. The sudden skip from one side of the street to the other made her at least five minutes earlier at her destination. And thus it went, boys, girls, old men and women had the same awful fear lest they should receive a fatal shock, and took precautions which were ludicrous in the extreme.—*Albany Journal.*

KINDRED INTERESTS

The Electric Engineering and Supply Company, Syracuse, N. Y., report quite a run on their new fuseless rosette.

The Hill Clutch Works, of Cleveland, O., have just taken a large order for clutches from the Cincinnati Electric Light Company. Mr. S. S. Leonard secured the contract.

Frink's Reflectors.—In a letter to Mr. I. P. Frink, 551 Pearl street, New York, dated Columbus, O., January 6, 1892, Prof. Benj. F. Thomas writes: "The lighting of the Senate and House assembly rooms by electricity is giving most excellent satisfaction and the reflectors furnished by you are much admired."

The firm of Clay, Pepper & Register, electrical engineers, Provident building, Philadelphia, was dissolved by mutual consent on the 15th inst. The business will be carried on as heretofore by Messrs. Pepper & Register. We predict for the new firm a continuance of its excellent record of the past.

Chas. A. Schieren & Company, 45-51 Ferry street, New York, have recently received the following testimonial letter:

THE ROUNDHAY ELECTRIC TRAMWAY,
146 Roundhay Road, Leeds, England.
January 16, 1892.

Messrs. CHARLES A. SCHIEREN & Co., 47 Ferry st., New York, U. S. A.

Gentlemen: We are ordering to-day from you a supply of your electric belt stuffing, also a supply of your belt cement.

Will you kindly send us full instructions for splicing your perforated belts? It may interest you to know that the two belts furnished by you for this plant are giving every satisfaction, and have elicited considerable admiration from English engineers.

Yours truly,
The Roundhay Electric Tramway,
J. E. WINSLOW, Manager.

Westinghouse, Church, Kerr & Company, Westinghouse building, Pittsburgh, Pa., have just issued a preliminary pamphlet on the subject of power plants for electric railways and describing their single-acting compound and triple-expansion engines, as now especially designed by them for direct coupling to the slow speed railway generator. Much valuable information is given in a clear, concise manner, and some very flattering results are shown in economy and regulation from tests of their engines in actual practice. This enterprising firm is always to be found in the front rank and thoroughly up to the times. The pamphlet is well worth the reading.

Among the prominent plants H. Ward Leonard & Company are at present installing, as contractors, are the following: *Mail and Express* building, Catherine Bradley building, Geraldine building, Germania Insurance building, Du Vivier & Company building, F. O. Du Lous building, Fifth Avenue Theatre, Graham Hotel and Mr. John H. Inman's residence, Fifth avenue, New York; Franklin Trust building, Columbia Theatre, Brooklyn; Curtis residence, Greenwich, Conn. Among the leading concerns for whom they are acting as consulting engineers, are the following: Otis Elevator Company, New York city; Wm. Sellers & Company, Philadelphia; Ingersoll-Sergeant Drill Company, New York city; Eastern Electric Company, Limited, St. Johns, N. B.; Providence Journal Company, Providence, R. I.; Middletown Music Hall, Middletown, Conn; Rock Hill Electric Light Company, Rock Hill, S. C.

The Sterling Company, Pullman building, Chicago, Ill., manufacturers of the well-known type of water tube safety boilers, have recently closed contracts with the following prominent concerns throughout the country: Carnegie, Phipps & Company, Pittsburgh, Pa., 1,200 horse-power; San Francisco and San Mateo Railway Company, San Francisco, Cal., 1,250 horse-power; Los Angeles Consolidated Electric Company, 1,500 horse-power; Pacific Rolling Mills Company, San Francisco, Cal., 1,500 horse-power; Braddock Wire Company, Braddock, Pa., 600 horse-power; Cincinnati Wire Works, Cincinnati, O., 1,200 horse-power; Cold Storage Company, Chicago, 1,800 horse-power; Minneapolis Street Railway Company, Minneapolis, Minn. (second order), 2,000 horse-power; Toledo Water Works, Toledo, O., 1,500 horse-power. This company has sold over 100,000 horse-power in the last three years, all giving satisfaction. The "Stirling" is well worth investigating. Their Boston agent, J. Bradford Sargent, 620 Atlantic avenue, will furnish catalogues, etc., on application.

PATENTED 1891.

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I am in search of a good insulation for electric wires. Persons having either a patent compound or a private formula may address as below with date and number of patent, all necessary information, samples of both wire and compounds, if possible, records of tests, etc. All information will be treated in strict confidence.

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Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

Bolt Cutters, ¼ in. to 1 in., ½ in. to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

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59 South Canal St., Chicago, Ill.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JANUARY 19, 1892.

467,350 Electrolytical plant; Otto Stalmann, Anaconda, Mont.

467,358 Regulator for electric generators; Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

467,372 Galvanic battery; Fernand Gendron, Bordeaux, France.

467,448 Electric railway; 467,449 Controlling apparatus for electric motors. 467,450 Electro-magnetic reciprocating pumping engine. 467,451 Reciprocating electric engine; Charles J. Van Depoele, Lynn, Mass.

467,465 Electric lock; Frederick S. Holmes, Boston, Mass., assignor to James W. Torrey, Philadelphia, Pa.

467,478 Electric railway signal; William F. Z. Desant, New York, N. Y.

467,484 Electrolytical process and apparatus for carrying out said process; Otto Stalmann, Anaconda, Mont., assignor to Marcus Daly, same place.

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467,504 Electric switch. 467,505 Electric indicating instruments; Henry J. Haight, New York, N. Y.

467,509 467,510 Electric drill system; Harry N. Marvin, Syracuse, N. Y., assignor to the Marvin Electric Drill Co., same place.

467,511 Hanger for electric lamps; David B. Matson, Buffalo, N. Y.

467,520 Composition of matter for insulating purposes; David H. Piffard, New York, N. Y.

467,523 Incandescent electric lamp; Edward P. Roberts, Cleveland, O., assignor to the Swan Lamp Manufacturing Co., same place.

467,530 Phonograph; John H. White, Washington, D. C.

467,537 Alternating current motor. 467,538 Electric heater; Ludwig Gutmann, Pittsburgh, Pa.

467,540 Electric switch; Charles J. Klein, New York, N. Y.

467,542 Carbon brush holder. 467,543 467,544 467,546 467,547 Apparatus for charging secondary batteries. 467,545 Charging secondary batteries; Cyprien O. Mailloux, New York, N. Y.

467,551 Automatic electric controller for air pumps; Adolph Bergmann, New York, N. Y.; Bertha Bergmann, administratrix of said Adolph Bergmann, deceased.

467,573 Secondary battery; Justus B. Entz, New York, and William A. Phillips, Brooklyn, N. Y.

467,576 Incandescent electric lamp; Harry J. Gutman, Des Moines, Iowa.

467,581 Electric railway signaling apparatus; Frank I. Myers, New York, N. Y.

467,583 Trolley wheel for electric cars; Levi A. Simons and George R. Roof, Omaha, Neb.

467,610 Electric arc lamp; John A. Mosher, Abilene, Kan., assignor to the Mosher Arc Lamp Co., same place.

467,611 Rheostat; John A. Mosher, Abilene, Kan.

467,613 Contact board for rheostats; Sidney H. Short, Cleveland, O.

467,645 Magnetic separator; Francis H. Richards, Hartford, Conn., assignor of two-thirds to Oscar S. Greenleaf, Springfield, and Roswell M. Fairfield, Holyoke, Mass.

467,650 Apparatus for laying underground conduits for electric wires; Horace B. Camp, Cuyahoga Falls, O.

467,651 Electrical signaling apparatus; Patrick B. Delany, South Orange, N. J.

467,656 Electric arc lamp; Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Co., same place.

467,669 Meter for electric translating devices; Henry H. Cutler, Newton, Mass.

467,678 Station indicator; Ruben B. Ayres, New York, N. Y.

467,679 Electric conductor support; Eben M. Boynton, West Newbury, Mass.

467,699 Electric railway; Warren B. Hutchinson, Passaic, N. J.

467,716 Incandescent lamp socket; Patrick Dunn, Cleveland, O.

467,738 Adjustable electrode for dental purposes; William P. Horton, Jr., Cleveland, O., assignor of one-half to Ansel B. Jones, same place.

467,748 Electric clock; Frank A. Ellis, Toronto, Canada.

467,752 Arc metal working apparatus; Henry Howard, Halesowen, England.

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